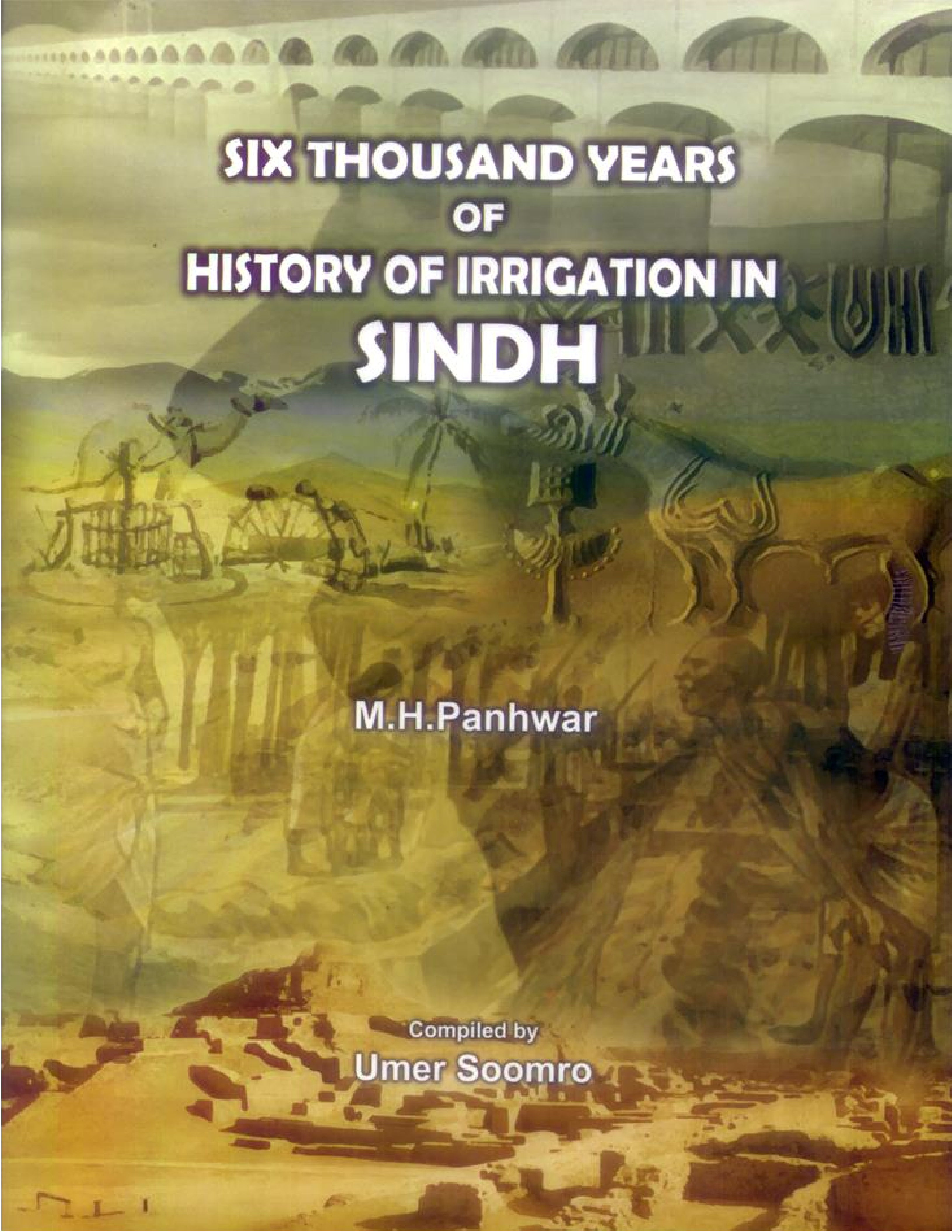

SIX THOUSAND YEARS OF HISTORY OF IRRIGATION IN SINDH

M.H.Panhwar

Compiled by

Umer Soomro

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By

M. H. Panhwar

(SITARAE IMTIAZ)

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CHAPTER 1

INTRODUCTION

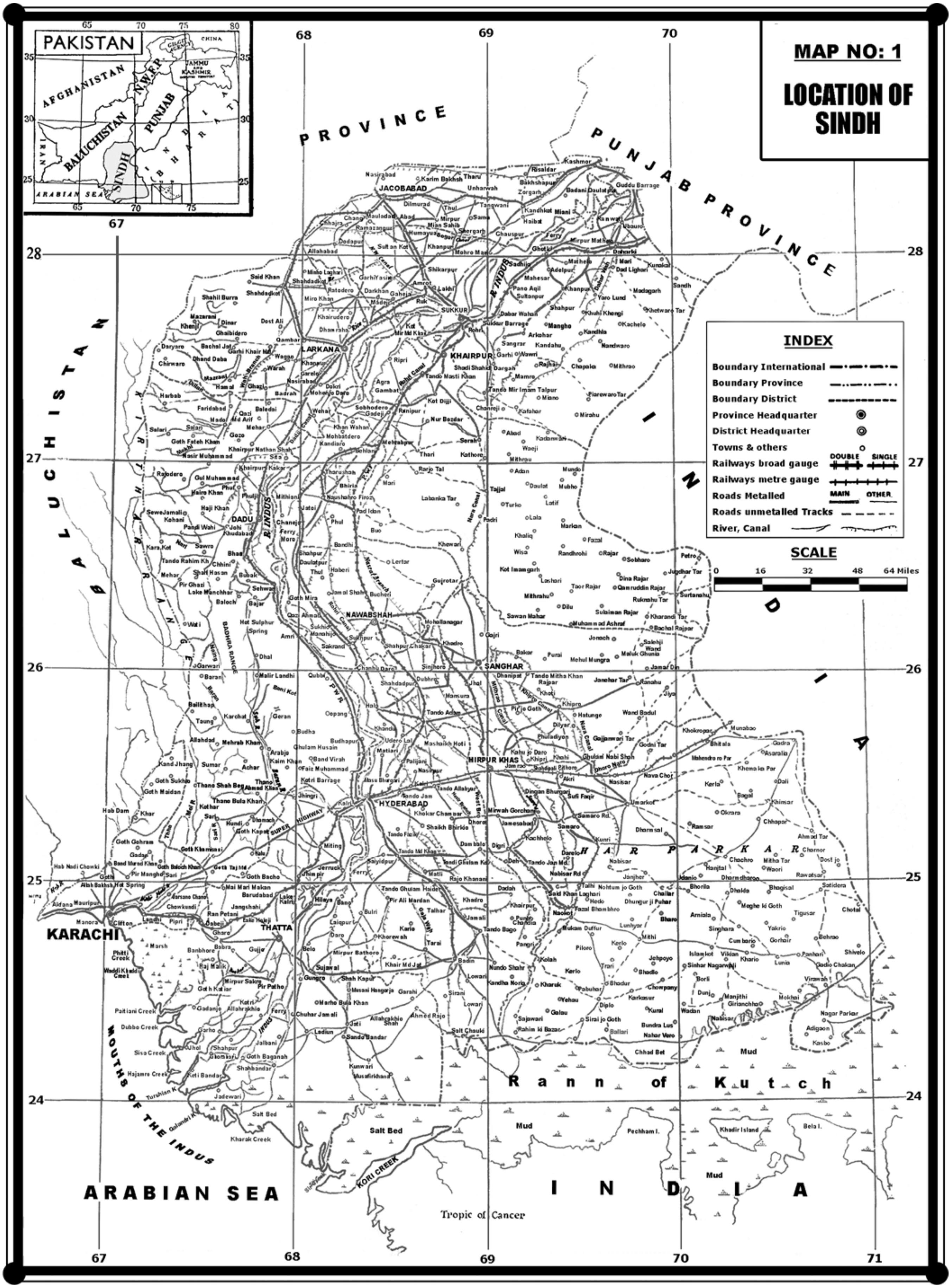
GENERAL

Definition of the history is: It is the history of production, history of the means of production, history of control over the means of production and history of distribution of production. Since soil, water and climate control the production and environments too control it directly, thus the history essentially is the history of environments of the past. The province like Sindh, which to its western hill tracts (Kohistan) is an extension of Irano-Baloch desert and the eastern sandy Thar is an extension of the Great Indian desert. It is essentially a desert, but its central alluvial plains, which are irrigated by the River Indus, make that area a vast oasis in the midst of the two harsh deserts of the world. The history of Sindh therefore is the history of production by the River Indus and the history of its changing courses, which invariably have led to famines, starvations, deaths and change of dynasties, each with such catastrophe. The Indus plains have supported as much as eighty percent population of Sindh. The fluctuations in the level of River Indus are governed by snow melts in the Himalayas. When summers are mild and snow melt is reduced, the level of water in the Indus goes down. In such cases canals do not flow to their full capacity, the area under cultivation is reduced and so the productivity. When it is warm in the Himalayas canals flow full and area under cultivation is increased. The level of water in the Indus is also governed by the rains in the catchments of its five tributary rivers in Punjab and Kashmir. When rains are sporadic flood conditions prevail in the Indus in Sindh. Thus history of production in Sindh also depends upon climatic conditions in the east and the west Punjab, Kashmir and the Himalayas ranges to their north.

The Thar and the Kohistan support about twenty percent of the total population of Sindh on pasturelands and their prosperity depends upon the rain fall in Sindh. When there are long periods of cold, rain fall is also reduced and thus reduces the area under cultivation. The people then resort to pastoralism. Since pasture can not support the whole population of Sindh, famine conditions prevail and population is reduced due to over all low production. When the production is low, not only population is reduced but also quality of socio-economic life is affected in all spheres of life.

To control the production and its distribution the ancients developed caste system: kings (Khatris) to subdue the people by the force of armies; Brahmans (educated and religious people) to collect taxes, administer on behalf of kings and to regulate and distribute production among the whole population - not according to their contribution to production but according to their ability to buy; Vaishas to own the land and get it cultivated and trade in various items of production and finally the artisans and farmers (Sudras), to produce goods and services for the use of the above three communities as well as for themselves. The caste system probably originated during the Early Indus Civilisation and was adopted by the people who professed the Aryan religion, many a millennia later. The caste system existed in Mesopotamia, ancient Egypt, Meso-America and Hwang Ho (the Yellow River) valleys. Thus there is nothing wrong with caste system, as it was developed to encourage production and regulate its distribution. The caste system became oppressive and rigid in a decadent society in India later on and its influence on production became negative.

To understand production in a country like Sindh we have to know irrigation, which was primitive until 1850 AD and in addition behaviour of the Indus was not known. It is mainly due to extended efforts of the British engineers and some administrators for almost a century that the behaviour of the River Indus in Sindh became clear. The river comes laden with silt, which in the inundation season easily reaches six parts per thousand parts of water. In Sindh the slopes do not permit adequate velocities to water to hold all this silt in suspension. This specially happens in areas where water overflows bed of the river. The silt thus gets deposited more on the banks and less in bed of the river. The process continues for many decades


MAP NO: 1
LOCATION OF SINDH
PAKISTAN
AFGHANISTAN
N.W.F.P
PUNJAB
BALUCHISTAN
SINDH
IRAN
ARABIAN SEA
CHINA
INDEX
Boundary International
Boundary Province
Boundary District
Province Headquarter
District Headquarter
Towns & others
Railways broad gauge
DOUBLE
SINGLE
Railways metre gauge
Roads Metalled
MAIN
OTHER
Roads unmetalled Tracks
River, Canal
SCALE
0
16
32
48
64 Miles
PUNJAB PROVINCE
BALUCHISTAN PROVINCE
INDIA
JACOBABAD
SHIKARPUR
SUKKUR
LARKANA
KHAIRPUR
DADU
NAWABSHAH
SANGHAR
HYDERABAD
MIRPUR KHAS
THATTA
KARACHI
THARPARKAR
KIRTHAR RANGE
MOUTHS OF THE INDUS
Rann of Kutch
ARABIAN SEA
Tropic of Cancer
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until the river flows on a ridge above the surrounding country protected in its bed by embankments thus created by it. One of the days it leaves the ridge and starts flowing in a low lying area, gradually raising it again. This process has been in action throughout Sindh's recent geological history. Sir Claude Inglis, a well known engineer of Sindh, discussed the question and produced a contour map and possible ancient courses of the river.

Lambrick in his "History of Sindh" (1964) elaborated Inglis' hypothesis and suggested various courses of the River Indus since Alexander's time. This highly polished work was based on the writings of Haig, Cousens, Whitehead, Stein and many others. Pithawalla, who also used all the above sources except the last one, had arrived at the same conclusion in 1936. In continuation of Lambrick's work the present writer drew a map of courses of the River Indus based on aerial photographs in 1966. D. A. Holmes and Wilhelmy are the two latest workers on the courses of River Indus.

These studies show that the ancient courses of the River Indus were almost parallel to its present course and they have left ridges on which the major canals of today are aligned. The branch canals are also aligned on some other ridges and so are minors. The courses drawn from aerial photographs show that there is no place in the central alluvial plains of Sindh, more than six kilometres long and six kilometres wide, which has not been intercepted by the River Indus at one time or another during the past 10,000 years, after Sindh emerged out of receding sea, which had flooded the whole of Sindh up to Multan 12,000 years back. A map of these courses from aerial photographs on 1:250,000 scale and size 40 x 90 inches has been drawn, covering the past five to six thousand years or since the time of the Early Indus Civilisation. Some old beds of the river were actually utilized as canals as much by ancients as by latest ruling dynasties - Kalhoras and Talpurs. The British used them for alignment of the Sukkur Barrage canals in 1932. They were also used for Guddu and Kotri barrages' canals as late as 1960 and 1963 respectively.

When the river changed its courses the irrigation system in the affected area was totally destroyed bringing about migration of people, chaos, disease, famine, starvation, death and consequently decrease in population. This has been the history of Sindh for the past five thousand years - that of prosperity, high population, depression, reduction in population, change of dynasties, rise and decline of civilisations and abandonment of cities and settlements, each leaving behind heap of ruins popularly known in Sindh as "Daro" or mound of earth with scattered shreds of pottery, burnt bricks and some artifacts. Thick forests only guaranteed limited stability of the river in its active flood plains. The forests kept velocities of water low in the flood plains and high along active course. This caused heavy silt deposition along the embankments covered with trees and as the level rose high there stood more chances of the river's abandoning old bed and also abandoning the irrigation canals, which had their heads not in the active bed of the river but away from it in the active flood plains, usually having forests around it.

This pattern of tapping the river for irrigation continued until 1932, when the Sukkur Barrage was constructed to irrigate sixty percent of total area of Indus plains in Sindh. In another thirty years rest of the two barrages were built. The heads of many canals, as they stood before the barrages, still exist within the flood protective embankments and can form a subject of special interest to archaeologists. The old canals, which were partially merged into new canals, have their un-merged portions partially intact, at least at the present, though many settlements along their embankments have disappeared and have gradually been reclaimed for cultivation.

In the pre-British period there were no levees or embankments to contain the river within its flood plains, which were twenty to thirty miles wide. In order that in the inundation season the permanent villages and towns are not wiped away embankments were constructed around them and were strengthened from year to year, but in real sense they were not a guarantee against breaches. Rodent and reptile holes occurred and went un-noticed until flood waters entered and widened them. Since anything could happen during floods in cases of major threats women and children were evacuated along with grains and cattle, able-bodied men patrolled the banks and old men watched the houses. Once water entered the settlement usually the higher spots were not flooded and old men stayed behind to witness falling of mud-house walls and thatched roofs.

Before the British conquest of Sindh in 1843 AD with exception of very large towns like Sukkur, Rohri, Shikarpur, Hyderabad and Thatta, possibly, there were no burnt brick houses. Burnt brick was limited in its use to religious structures i.e., mosques and tombs. Sindh had developed another peculiar architecture for mud wall construction in two or three storied houses. This type of structure is now

RURAL HOUSINGS


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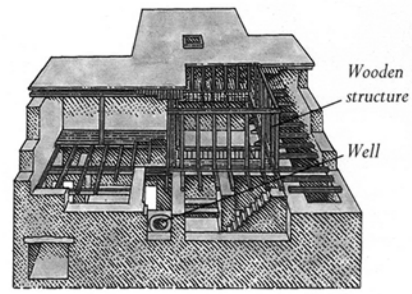

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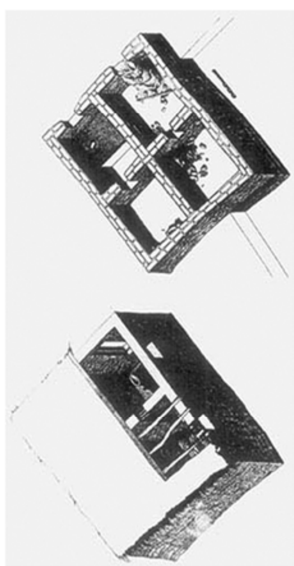

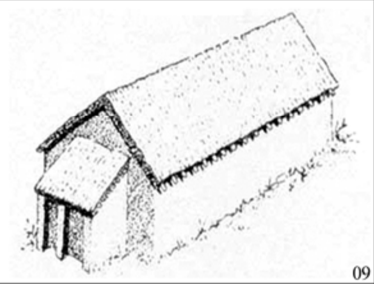
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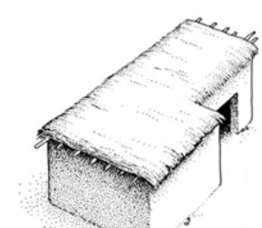
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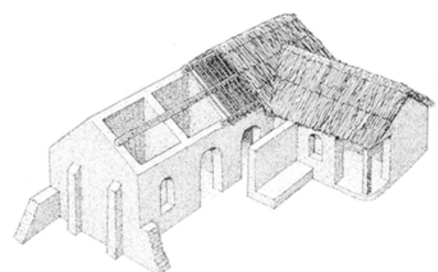
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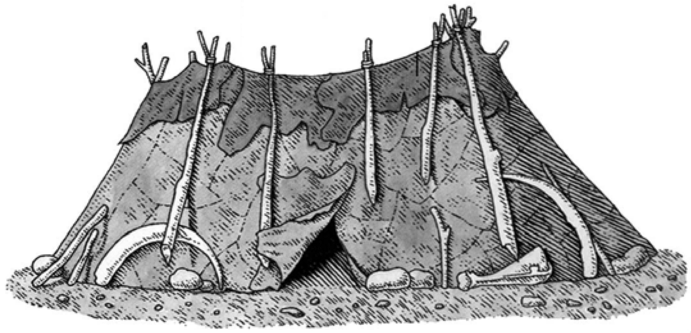

13

RURAL HOUSING

001. Housing in Thar
002. Rural Sindh Housing
003. & 004. Rural thatched house.
005 & 006. Thatched House.
007. House, Mohenjodaro, Indus Valley 2500 BC
008. House Plan of Mehrgarh
009. House, Tepe Hissar 2500 BC
010. Mongol movable circular tent on light wicker portable frames and easy to dismantle or reassemble. (ELA).
011. Mud House 7000-500 BC.
012. Rectangular house, Hassuna 2500 BC.
013. Leather Tent House 10,000 BC

disappearing and needs protection like old monuments. The anti-flood protection method of house construction was unique and probably limited to Sindh. Foundations were excavated more than a metre deep to form the mud wall foundation, but before pouring and pressing wet mud lumps in these foundations a reinforcing structure of wooden branches or poles about 3.5 to 5 centimetres diameter was erected just like reinforcing of walls in earthquake areas. Wooden poles were laid at every 8 to 12 centimetres vertically and horizontally. Wood was well cured, dried and coated with some material. The reinforced structure was 4.5 metres high for a single story, 7.0 metres for double story and 9.5 metres for three stories. At ceiling level reinforcement for support of roof was increased by providing a number of poles laid edge to edge horizontally on the top of mud wall to from a wall beam to take load of wooden beams and rafters for the roof. The foundations and walls were packed with clay mud, which was laid in layers about 40 cms high and allowed to dry for a week or two before adding another layer. Since clay absorbs water it shrinks on drying and develops cracks, these cracks were filled with wet mud and finally plastered with 1 to 1.5 cm thick mud and wheat or rice straw mixed together. Straw acts as reinforcement and if mud diluted in water is applied above it in a thin layer of one to two millimetres it becomes air tight. The floods, if they came in the town, could at the most damage outside mud to a depth of half to three quarters of a metre, but water could not enter the house as its ground floor was filled with earth to a depth of about a metre or more before laying bricks floors. Such houses have disappeared in Mathelo, Larkana, Halani, Kandiaro and Nasarpur giving place to brick wall houses, but a few still exist in Sehwan, Rohri and Thatta. Flood water actually entered Thatta in 1955. The town was submerged and some houses collapsed but all wood reinforced mud houses, even three storied, defied the Indus flood. Forty years ago the present author stayed on the third floor of a house, which probably was constructed for a Mughal noble man some three hundred or more years ago. Each floor had a bathroom lined with lime plaster and had recently been partly repaired with cement and concrete. Drainage pipes, as they existed, were made of burnt clay tiles, telescoped and lime plastered. Today these are archaeological monuments and need protection as such, but none has thought of them and may be replaced by the owners with brick houses in a decade if action is delayed.

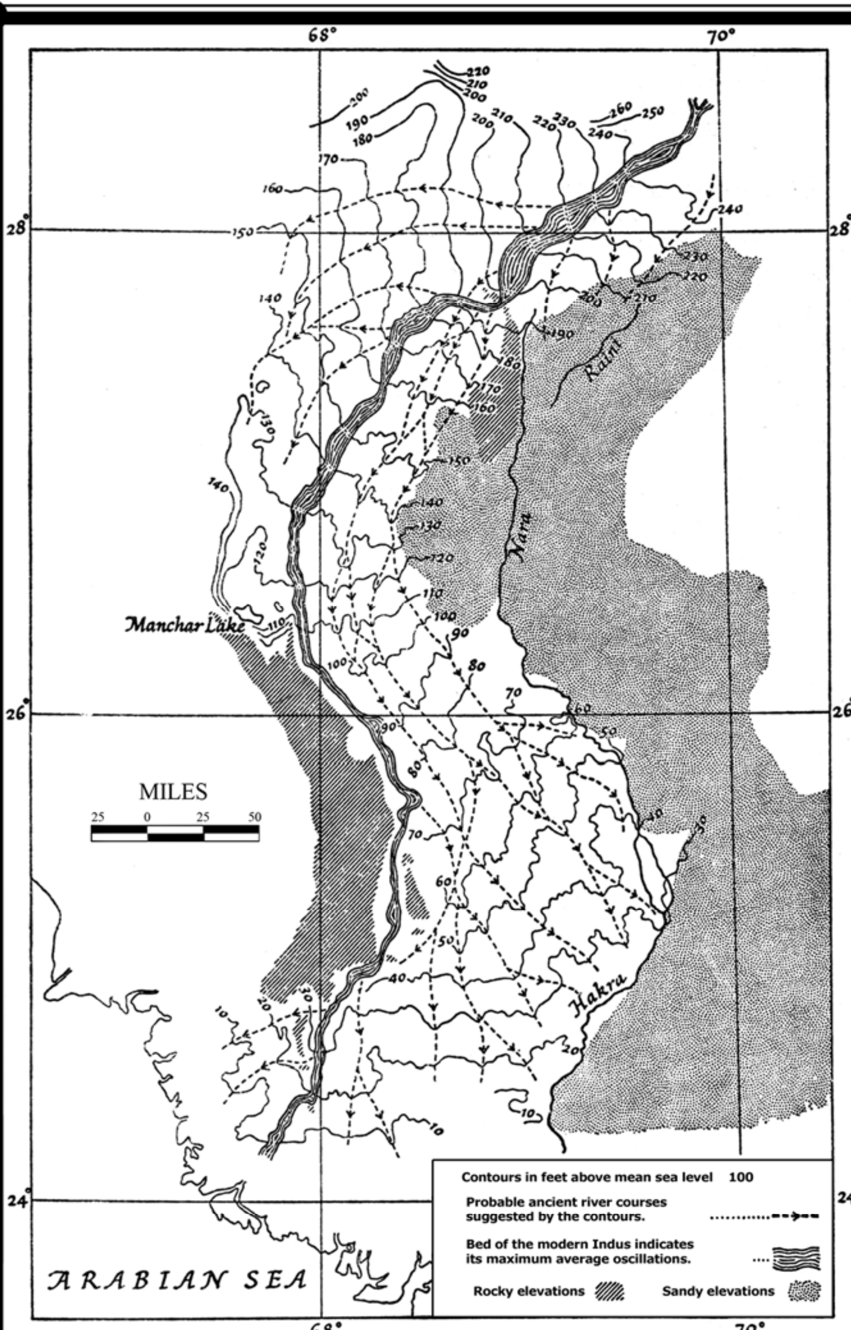
A modification of this design was; houses were made from babul (acacia nilotica) wood. Wooden planks about 25 to 35 mm thick were laid edge to edge and nailed together with 25 – 35 mm diameter wooden pieces of tamarisk, each about 75 to 100 millimetres long, and nailed at 75 to 100 millimetres intervals along the whole length of planks. This was the type of construction of late eighteenth or early nineteenth century, as they invariably have used machine made iron nails and doors’ and windows’ hinges and bolts, typical of that age. The enclosed photograph shows a three story house of that period still under occupation and although outside mud plaster is wearing out the inside is kept in a good shape. The house is leaning on one side but it does not disturb the occupants. At least one dozen such houses are still occupied. All of them were submerged more than a metre deep in 1955 floods for two to three weeks and yet they did not collapse.

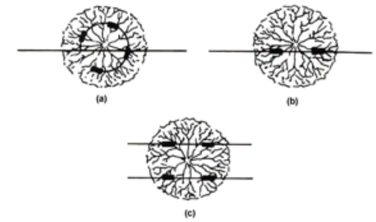
The poor men’s houses had walls of thin tamarisk branches (1.5 – 3 cms diameter) fixed edge to edge in 3 - 4 rows vertically and woven together by similar branches running horizontally about 30 cms apart. They were further strengthened by reed ropes. They too defied the flood and were a common feature in the active riverine flood plains. History of irrigation in this book is history of agriculture and agro-industrial products, which lead to rise and fall of civilisations, dynasties and kingdoms, prosperity, poverty, famines, starvation and deaths of people who depended on the vagaries of River Indus and its waters.

M. H. Panhwar

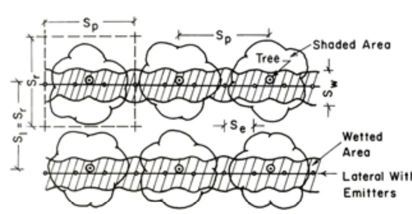
MAP NO: 02

Contour Map of Sindh and Possible Ancient Courses of the Indus and Its Branches During Holocene

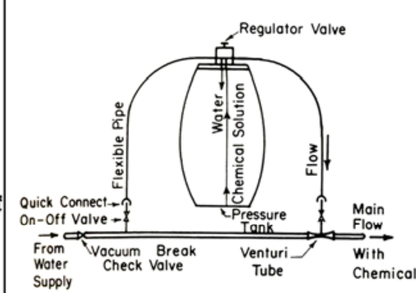




14. Example drip emitter layouts: (a) Tree ring (pig tail); (b) single lateral with two emitters and (c) dual laterals with two emitters each

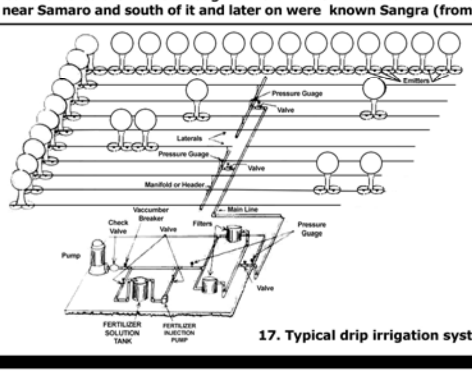


15. A. Single lateral for each tree row. S_p = plant spacing; S_r = row spacing; S_w = width of wetted strip; S_e = emitter spacing; S_1 = lateral spacing.



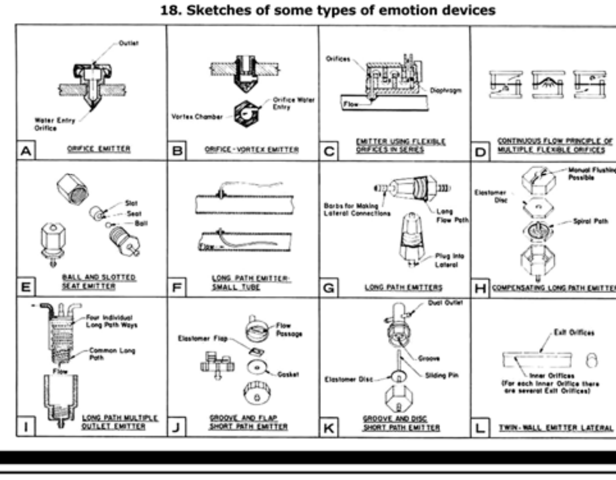
16. Pressure-differential injection system

This map of claude Inglis, one time Executive Engineer Research in Sindh and author of Bund Manual, traced possible major courses of the Indus and its branches during the past 2500 years from contours of Sindh in 1949. This map has been used by many historical geography writers like Pithawala, Lambrick and others and these have been verified from aerial photographs by this aurthor. The courses also show that the western branches re-entered the Indus through Manchar Lake and eastern branches entered Hakra near Samaro and south of it and later on were known Sangra (from Sangra or Hakra)



17. Typical drip irrigation system

18. Sketches of some types of emotion devices



CHAPTER 2

CHRONOLOGY OF IMPORTANT CULTURAL EVENTS AND DYNASTIES OF SINDH

S. No.	Event	Years
1.	Stone Age in Sindh	500,000 - 4,000 BC
2.	Very dry climate	Before 9,000 BC
3.	Very dry to beginning of low wet period	9,000 - 7,500 BC
4.	Climate changes to medium wet	8,500 - 7,500 BC
5.	High wet climate	7,500 - 4,000 BC
6.	Medium wet climate	4,000 - 1,750 BC
7.	Hyper arid climate	1,750 - 900 BC
8.	Medium dry climate	900 BC - 500 AD
9.	Mesolithic period in Sindh	10,000 - 6,000 BC
10.	Beginning of Neolithic revolution in Sindh	7,000 BC
11.	Beginning of Chalcolithic period in Sindh	4,000 BC
12.	Early Indus culture (Amri, Kot Dijji)	3,700 - 2,300 BC
13.	Mature Indus culture (Mohenjo Daro)	2,300 - 1,650 BC
14.	Declining Indus culture; · Jhukar · Jhangar	 1,750 - 1,350 BC 1,200 - 900 BC
15.	Rise of Rig Vedic tribes	1,050 BC Swat 850 BC Balochistan 800 BC Sindh
16.	Mahapadhayas (kingdoms) of the South Asia	600 - 500 BC
17.	Achaemeniansns	519 - 450/400 BC
18.	Sindh principalities	450 - 400/325 BC
19.	Alexander and his successors	326 - 323 BC
20.	Mauryans	321 - 184 BC
21.	Bactrian Greeks	184 - 70 BC
22.	Scythians	70 BC – 46 AD
23.	Parthians	46 - 78 AD
24.	Kushans (upper Sindh)	78 - 175 AD
25.	Parthians (lower Sindh) and the whole Sindh after 175 AD	78 - 175 AD 175 - 283 AD

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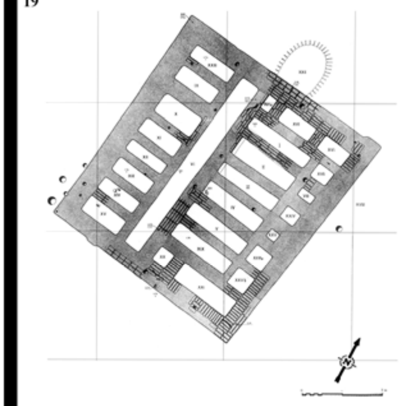

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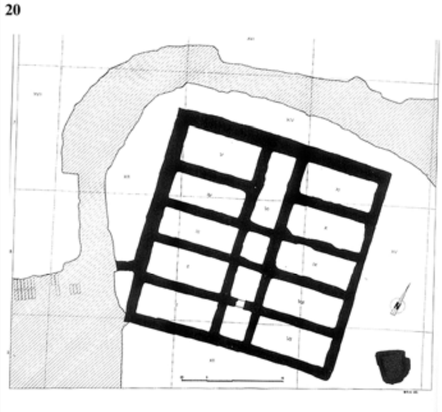

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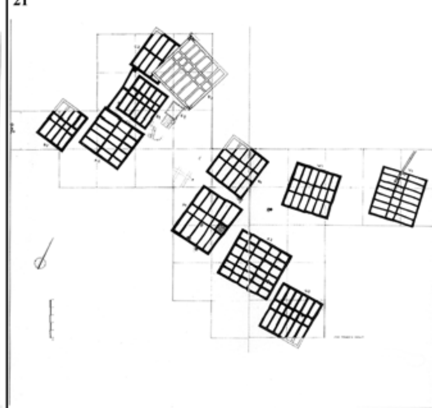

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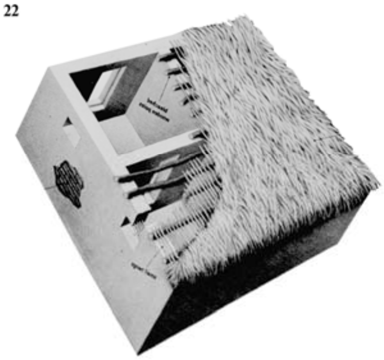

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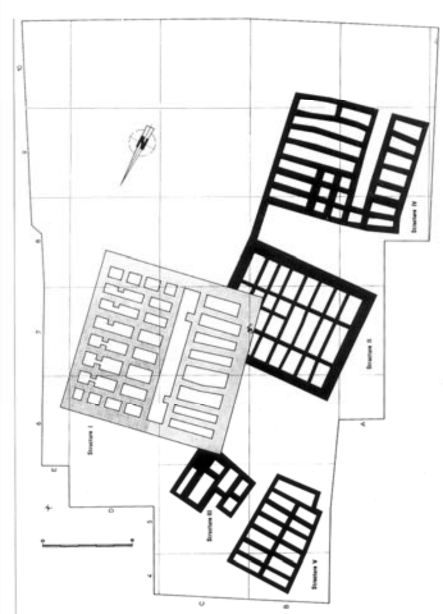

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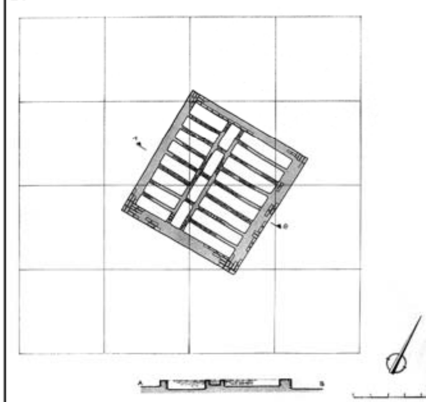

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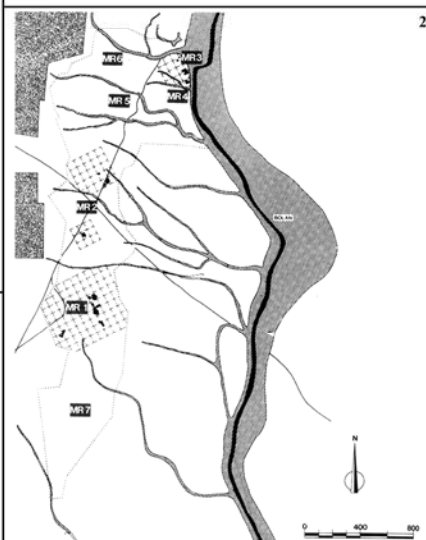

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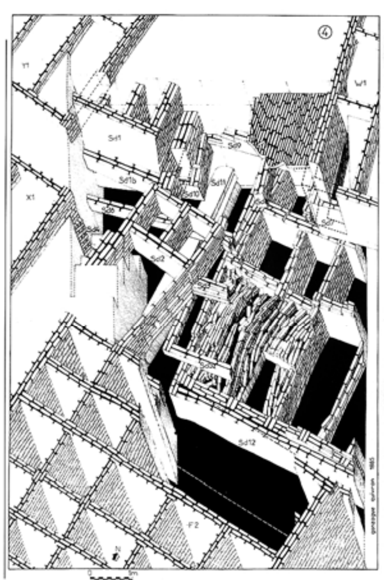

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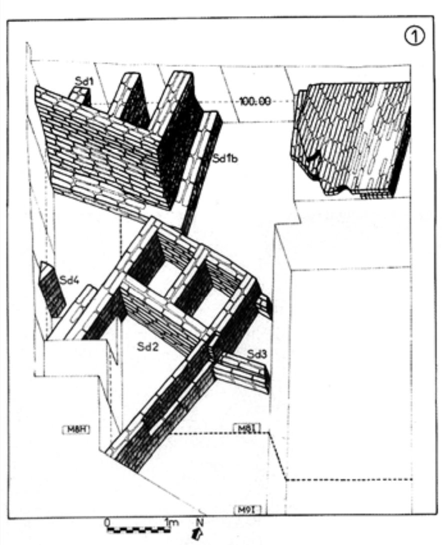
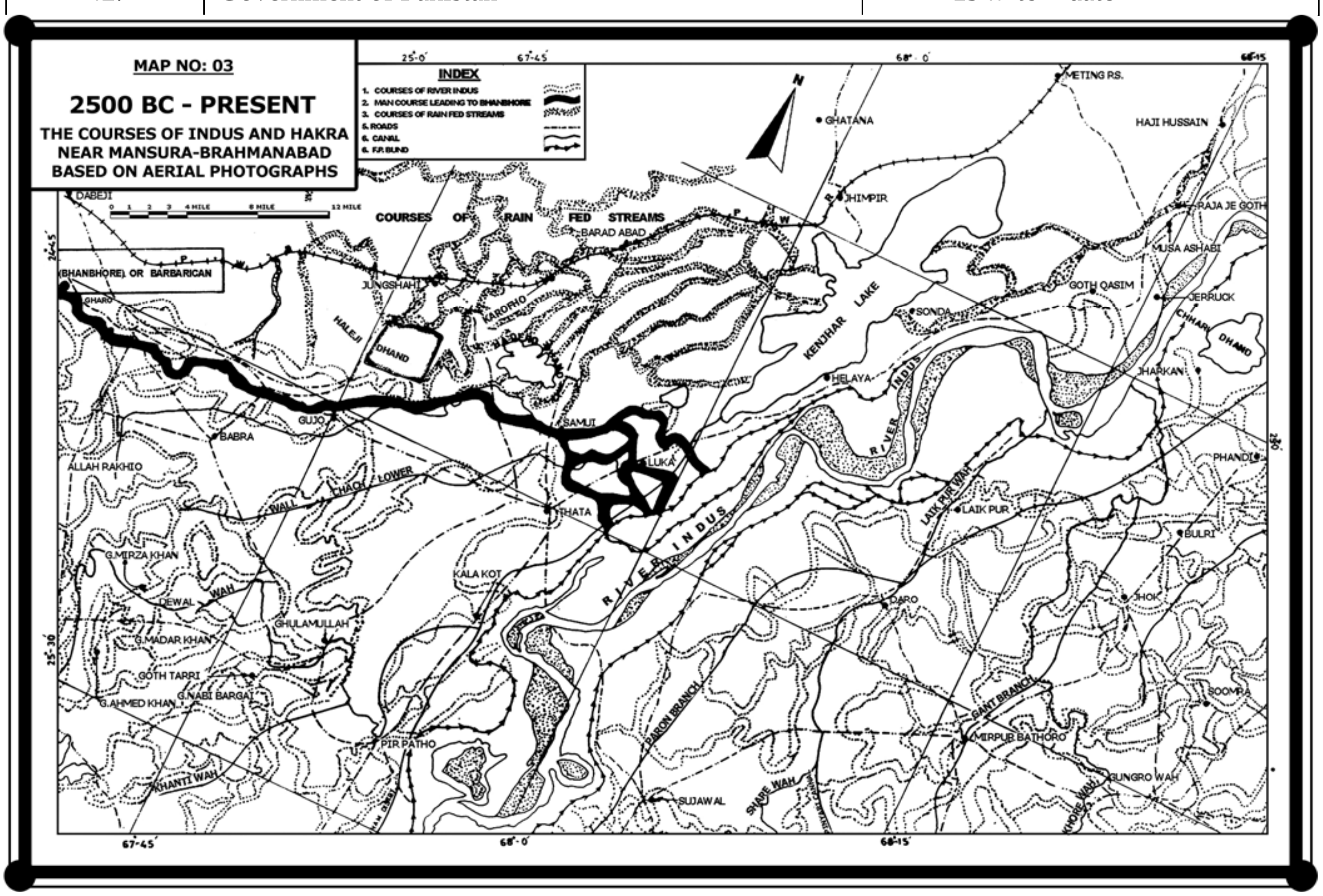


STRUCTURES OF MEHRGARH AND BRAHMANABAD

019. Plan of architecture of sector MR 2 X. Area MR 2 X, period III, Mehrgarh.
020. Plan of structure LI in sector AG, area MR 3/4, period IIA, Mehrgarh.
021. Plan of structure I-V in sector X, area MR 2, period III, Mehrgarh.
022. Reconstruction of house at Mehrgarh
023. Plan of structure I-V in sector X, area MR 2, period III, Mehrgarh.
024. Compartmented building in zone MR 2 F, area MR 2, period IIIB, Mehrgarh.
025. Covered drain with associated structures at Brahmanabad-Mansura. (DGA).
026. Distribution of archaeological zones of Mehrgarh
027. Surrounding sector M; isometric view of the building of period IIA, area MR 3/4, Mehrgarh.
028. Isometric plan of level 8, area MR 3/4, Mehrgarh.

26.	Sassanians	283 - 356 AD
27.	Vahlikas	356 - 415 AD
28.	Unknown Sindh principalities	415 - 500 AD
29.	Rais	500 - 641 AD
30.	Brahmans	641 - 712 AD whole Sindh 715 - 725 AD eastern Sindh
31.	Umayyad governors	712 - 746 AD
32.	Abbasid governors	751 - 854 AD
33.	Habaris	854 - 1011 AD
34.	Soomras	1011 - 1351 AD
35.	Sammas	1351 - 1522 AD
36.	Arghoons	1522 - 1554 AD whole Sindh 1554 - 1587 AD upper Sindh
37.	Tarkhans	1554 - 1591 AD
38.	Mughal governors	1587 - 1591 AD upper Sindh 1591 - 1700 AD whole Sindh 1701 - 1736 AD lower Sindh
39.	Kalhoras	1701 - 1783 AD
40.	Talpurs	1783 - 1843 AD
41.	British	1843 - 1947 AD
42.	Government of Pakistan	1947 to – date



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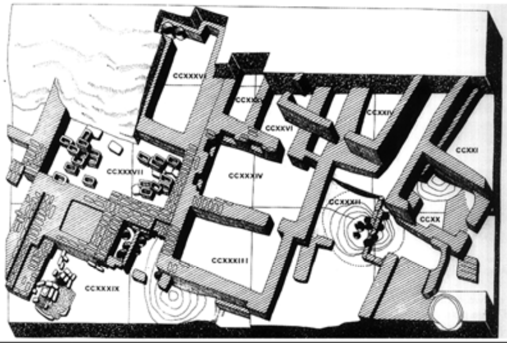

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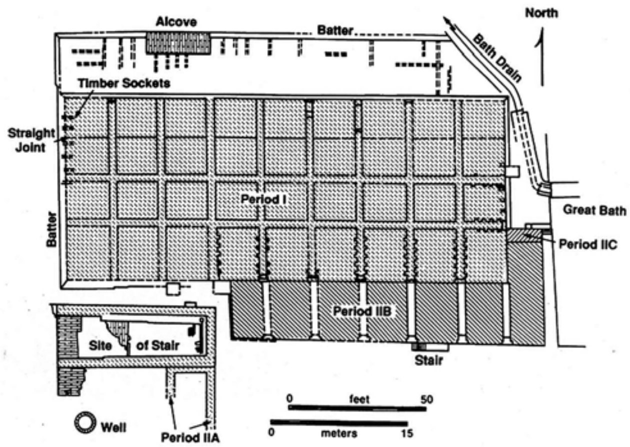

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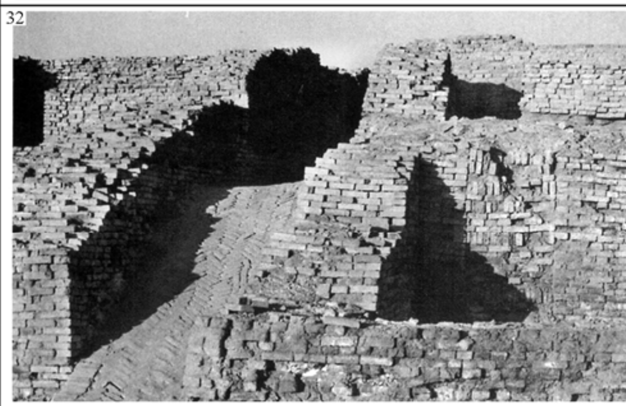

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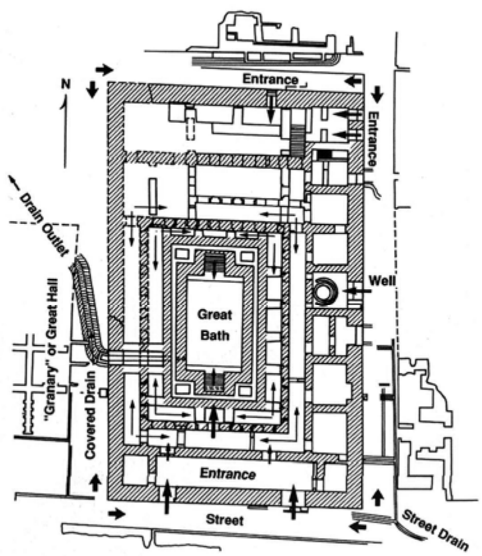

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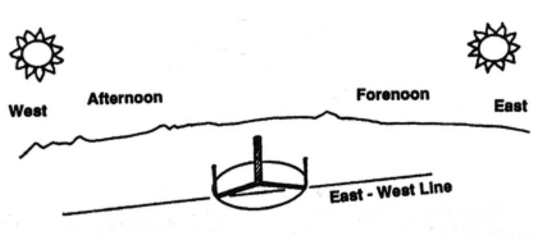

HOUSE PLANNINGS

029. Plan and isometric view of sector MR C, area MR 1, period IV, Mehrgarh
030. Public wells that were accessible from the street have been found in HR area at Mohenjo-daro, 2500 BC
031. Plan of granary at Mohenjo-daro, after Wheeller, 2500 BC
032. Brick buildings in HR area at Mohenjo-daro showing a blocked-up doorway and numerous building levels, 2500 BC
033. Plan of the great bath of Mohenjo-daro showing access routes after Jansen 1993, 2500 BC
034. A bathing platform in SD area at Mohenjo-daro with a drain leading out to the street, 2500BC
035. Drawing of east-west sighting technique

CHAPTER 3

BEGINNING OF IRRIGAITON

ANCIENT IRRIGATION CANALS AND THEIR PECULIARITIES

In order to understand the irrigation system, as was being practised before the advent of modern engineering methods of topographical survey and design, study of pre-British period canal system is necessary. Fortunately, for us there is complete record of pre-British canals, their lengths, areas under their command, the slopes and directions of canals, silting and de-silting problems and special levelling problems created by use of bare eye and human judgement against use of dumpy levels, rods and chains. Hughes Gazetteer of 1876 gives list of 729 pre-British canals and their sources of supply have also been listed. Following are a few conclusions, which apply to all canals operating form the days of early irrigation in Sindh:

- Canals lay obliquely to the direction of flow of the Indus in most of Sindh, exception being the area north-west of Sukkur and west of Kashmore. This was done to get better slope for the channels so as to reduce silting problems.
- No canal had its mouth where the river had relatively a permanent bank (Sukkur and Hyderabad).
- The canals were not deep enough to draw water form the main channel of the river in early or late summer and whole winter.
- The canals sometimes had sharp bends causing serious erosion or silt deposits.
- Old beds or abandoned branches of the river or parts of them often were converted into canals. Such branches often had poor slopes, awkward bends and needed annual cleaning year-after-year.
- Most of the canals supplied water by gravity during most of the inundation season, but acres of land must have gone out of cultivation. Occasionally, water had to be lifted from them by means of Persian wheels to irrigate adjoining lands. There were canals or major portions of them, which were flowing in the cutting and water had to be lifted from them to the adjoining lands all the time.
- Some important canals like Sindh Wah and Begari, instead of having mouth from the Indus, took off from Sindh Dhoro an old bed of Indus parallel to its present bed and filled with water year-after-year. Some of them were given more than one mouth.
- Choking up of mouth of canal by silting or fall into the level of river created precarious conditions for the farmers. Late rise of the river led to late planting or its early fall resulted into lack of final dozes of irrigation. In both cases the crops were poor. Lifting or pumping of water in itself was time consuming. Low lift Persian wheels for three to four feet head, supplying a quarter cusec of water at best and operating a maximum of eight hours a day, could not command more than eight acres during the inundation season. The farmer was not able to recover the labour charges assuming that animals were fed on pastureland without use of special feed grown for them and paid only for labour to operate Persian wheel and to graze animals.
- When river had no flood protective embankments floods were more frequent and the chances of destruction of crops high.
- No regulators were provided at the heads of canals.
- No consideration was given to the slope and cross section of the canals to maintain a velocity of water so that neither silting nor erosion may take place.
- Had the canals enough length and had they been planned that they will be sufficiently wide and deep and have free run for some miles before they supply water by gravity, water could have been made available to the farmers early as well as late in the season to ensure availability of irrigation water during the whole inundation season.

IRRIGATION EQUIPMENT

Boka or shaduf is water lifting device. The low lift Boka has a long pole to act as lever and is used since 2300 BC.For medium lift Boka is used over a pulley since 1500 BC. For high lifts in many metres, needs pulley and animal power to pull and is also equally old. Bucket wheel (Nar) or Sindhi wheel of Arabs and Persian wheel as the British named it, is also of two types, low lift for less than two metres depth of water and high lift from two to maximum six metres depth. It was a Greek invention as bilge-pump in ships around 250 BC and from this around 200 BC, evolved the bucket wheel. Around beginning of Modern Calendar (Christian Era), it was commonly used in Mediterranean countries and established it self in sindh in antiquity. Beyond six metre depths boka was used. Power pumps have gradually replaced these devices during second half of the last century, but in Thar of Sindh, Boka and in Kohistan bucket wheels are still used Sindh has rainfall of 3 to 8 inches (7.5-21 cms), but evaporation is 70-100 inches (178-254 cms) and therefore crops cannot grow without irrigation. Various types of irrigation devices have been used in Sindh since antiquity.

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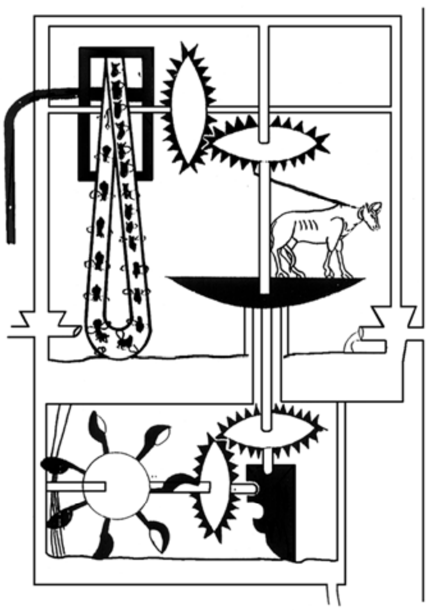

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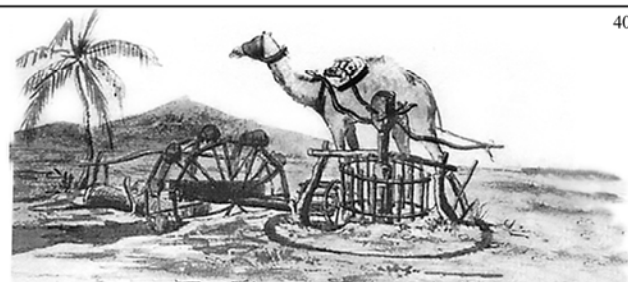

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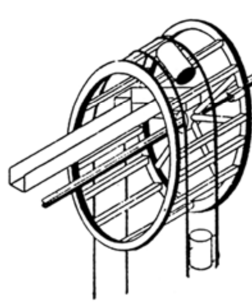

036,037 & 0039. Sindhi Nar. Bilge-pump used by Greeks in 250 BC to lift leaked water in the boats, gave rise ti devekopment of Sindhi Nar or wheel. Lift wheel was introduced after 200 and became popular to lift water from low-level canals to the fields. A large number of such wheels existed in Sindh in the 13th century or Soomra era. (Sindh Museum, Hyderabad).

0038. SIndhi wheel of 13th century. Drawing by Ibn AL-Qazzaz Al-Jazari in the book "Knowledge of Ingenious Mechanical Devices" written in 1204-1206 AD and translated by Donald Hill.

040. Low Lift Persian wheel. Reproduced in History of India by Francis.

041. Sindhi Loti or bucket of Sindhi wheel, tied by rope to endless belt of the lift wheel. It is identical to modern Loti. (Banbhore Museum, Banbhore).

042. Teak wood pulley from Brahmanadab-Mansura. (National Museum, Karachi).

043. Isometric view of Persian wheel endless chain and Buckets like 167. by Donald Hill.

- Due to these uncertainties beyond their control pessimism and fatalism has prevailed in Sindh's farming community over the centuries and everything is attributed to the will of the Almighty. It has done irreparable loss to their thinking leading to belief in superstitions.
- Since crop could fail any year, the farmers adopted animal husbandry as a source of additional income. As the river water flooded vast areas of land outside cultivated area and luxuriant grasses grew on them, farmers raised cattle on these pastures providing them with an assured source of income in the lean years.
- Since flooding of land and destruction in normal years must have taken almost same proportion for Sindh as a whole, loss of crops in terms of percentage under irrigation must have remained almost the same and production most probably changed very little except when major hydrological changes in the course of the River Indus took place. Before opening of Sukkur Barrage in 1932 AD every farmer was a pastoral too. Failure of one job therefore did not totally ruin the farmer. He sold his extra livestock to meet urgency.
- Some lands lying above the level of water in the canals, though within the command area and fertile, were left un-cultivated.
- Only Kharif crop could be grown on these canals. (Kharif crops are sown in June-July and harvested in September-October).
- Many times canals did not have their mouths in the river itself, but rather in lakes and depressions like Sindh Dhoro, which were filled up naturally or artificially in the inundation season. This helped in silt depositing in the depressions and canals did not have serious silting problems. On the other hand level of water in the lakes was always lower than the river; therefore canals did not attain the levels they otherwise could have, reducing the area under command and also the number of days water could be supplied. However fluctuation in level of water in these lake depressions was less than the main river during short intervals.

Due to these peculiar circumstances there were hardly any famines in Sindh. The only famines reported by Bhatia in Sindh since 1799 AD were in the upper Sindh in 1820 and 1822 AD and most probably were due to famous Kashmore floods destroying present Jacobabad, Shikarpur, Larkana and northern Dadu districts. Even recurrence of Little Ice Age may have caused it. Similar floods took place in 1942, 1948 and 1973 AD.

Sindh must, however, have faced famines for some years continuously since 1758 AD; when the River Indus changed its course near Hala abandoning its old bed passing near Nasarpur, Shaikh Bhirkio, Tando Ghulam Ali, Old Badin, Kadhan and Rahimki Bazaar to the present course, west of Hyderabad. As a result at least one million acres, which two centuries later were reclaimed, were re-irrigated after opening of Kotri Barrage canals in that area in 1961 AD.

THE HISTORY AND NEED OF WATER LIFTING DEVICES - BOKA OR SHADUF - IN THE ANCIENT SINDH

Boka (leather water bucket) was known in the Indus Culture times. Pulley was not known then. Boka therefore was pulled up the well by a long lever hinged over an inverted U-frame fixed in the ground (found at Lothal) or over a tripod similarly fixed. Similar device was in use in Egypt around 4,500 years ago.

The limitation to lift was the height of U-frame or tripod. Ordinarily it could not be over ten feet. Multiple-pulley was known in Mesopotamia around 900 BC. Simple pulley was much earlier innovation. Its existence in the Indus culture is not proved technologically. Its knowledge may have reached from elsewhere or may have been developed for irrigation during the declining Indus culture (1650 to 900 BC). It was in use in Egypt around 1500 BC and probably also in Sindh by this date.

The Boka seems to be originally a device adopted in Sindh from central India. It is similar to the one used in Deccan and Madhya Pradesh. Boka has an advantage over the Persian wheel in as much as it does not spill water back into the well. It has the form of a tea kettle with a spout. It is raised or lowered from its top with rope over a pulley. Other but smaller pulley kept at a lower level to pull spout. When the bag passes over the level of the smaller pulley the spout is pulled horizontally and the water rushes out from it into the outlet already built. Boka or shaduf of the mature Indus culture is discussed in chapter 9.

The disadvantages of Boka are:

- The animals for each turn have to walk forward and get back in the reverse. This walking back in the reverse is a very hard and slow job for the

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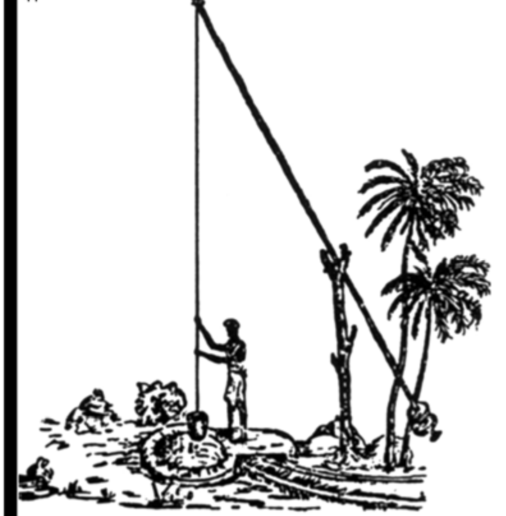

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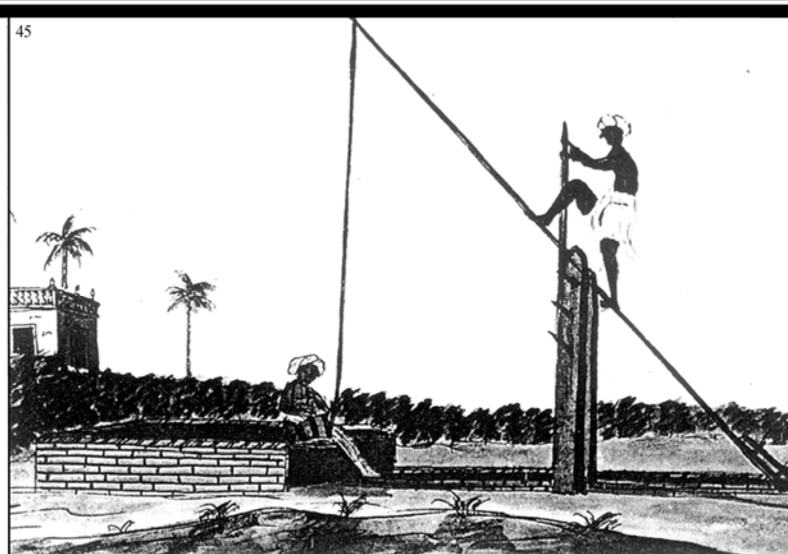

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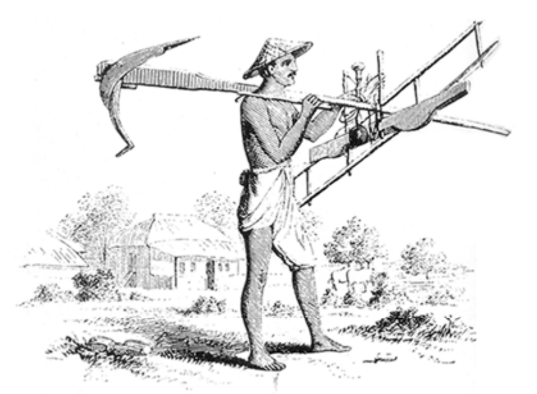

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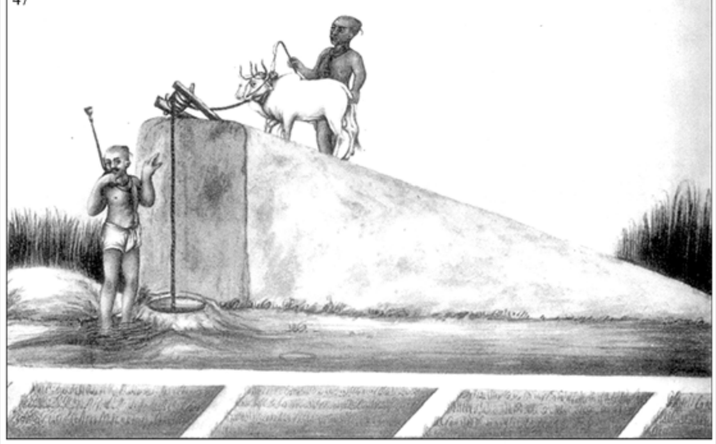

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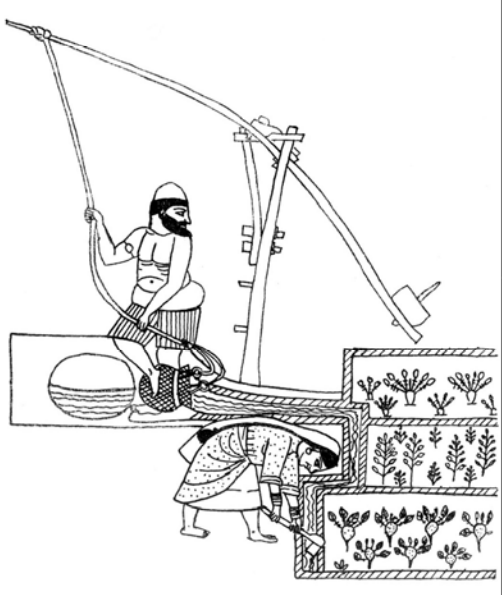

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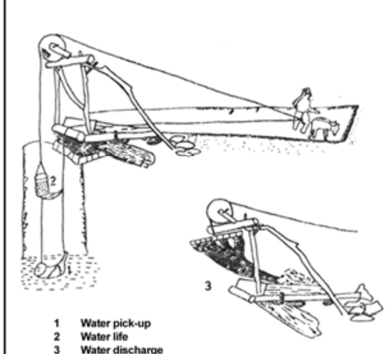

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IRRIGATION EQUIPMENTS

044. Boka as used in southern India, after Berkley 1893 AD.
045. Boka, similar to that used at Lothal around 2000 BC. Similar Boka is used in Thar desert areas even todeay (Soldier of Company).
046. The basic tools of husbandry, plough and harrow, remained unchanged until the last century.
047. Boka from Southern India based on "British India" by Edwardes.
048. Boka irrigation.
049. Boka irrigation in Thar.
050. Neolithic farmers were semi-nomadic. They cleared land and sowed crops, but when the soil was exhausted they moved on and began anew. 7500 BC.
051. Shadoof (ancient Egyptian picture).

All these primitive operations were common even upto 1980 AD

animals unless wells are very deep and animals can be made to walk normally in forward and backward direction while returning back.

- At least one person is needed all the time to guide the animals and another to watch the lower pulley and guide the rope over it.

The capital outplay on the Boka devise is much less than that on the Persian wheel, but its hourly discharge does not match with that of the latter and instead of two adults even a child was able to guide the animal in the case of Persian wheel.

ANIMAL POWER

Animal power used in Sindh may have been oxen to start with. Camel may have been used around 1000 BC. Camel is reported to have been domesticated in Saudi Arabia around 1200 BC. Camel bones found at Mohenjo Daro show its presence in Sindh around 2300 BC. Camel may well have been domesticated here in Sindh earlier than in Arabia and used as pack and riding animal. It may have pulled Boka and Persian wheel when their knowledge reached here. Once there were trade contacts between the Indus and Mesopotamia (present Iraq), use of pulley for loading of wooden logs may have been common on boats. The pulley therefore may have been present in the Jhukar times or soon after 1500 BC.

PERSIAN WHEEL

Persian wheel is a much later development. The gearing system used in it transmits power from a vertical axle to a horizontal axle by cogwheels working on the principle of bevel gears. Cogwheel was probably first designed by Achaemenians and Greeks for their war machines like wall scalers, stone throwers and etc., around 250 to 200 BC. The Greeks seem to have used cogwheel to develop water lift wheel now called Persian wheel. Low lift wheel may have been developed before high lift wheel. Persian wheel has limitation to lift water from long depths. It cannot work satisfactorily beyond 30 feet depth as the endless bucket carrying ropes will slip due to heavy weight of buckets filled with water without reducing the number of buckets. Boka is much more efficient than Persian wheel for depths of more than thirty feet.

Persian wheel may have reached Sindh during the Bactrian Greeks or Scythians rule from 184 to 80 BC and most probably in the second century BC.

Low lift Persian wheel is very efficient among the ancient water lifting devices and is only next to Archimedes screw, which again has limitation to very low heads of one to one-and-half metres above which it cannot perform satisfactorily.

Use of Persian wheel was common before the British and it was a must in more than fifty percent area in Sindh for raising and harvesting the crops successfully on the inundation canals. The number of canals taking off from the Indus varied between five hundred to one thousand at various times. The level of water in them varied with the level in the river. When the level was low as in late May or early part of June farmers used Persian wheels to sow the crops (specially cotton, rice nurseries, vegetables and fruits) and when water level receded in late September or early October water wheels were used to irrigate crops to maturity. The Persian wheels were operated by one camel or one or two bullocks depending on the lift and number of bucket on the endless string acting like a belt.

Camel was preferred as oxen needed better fodder and feed while camel browsed on wild shrubs and tree leaves. Camel also walks faster and does not tire soon.

Simultaneously with wind turbine, whose 4-blades were copied from sails of boats most probably, the wind mills operated Persian wheels. Persian wheels were not as popular in Iran as they were in Sindh. Medieaval Arabs describe the Persian wheel as Sindhi wheel.

Diesel operated pumps for irrigation were introduced in Sindh during the World War-I. Such centrifugal pump was operated by 32 H.P. Ruston diesel engine imported in 1917 AD was still in use at Sakrand in 1957 AD. Such diesel engines replaced Persian wheels during World War-I on the irrigation wells in Malir near Karachi as the water table had dropped from thirteen feet in 1860s to thirty feet in next 50 years. Today it is 100 feet or more deep.

PERSIAN WHEEL IRRIGATION IN SINDH IN THE PRE-BARRAGE (1932) DAYS AND ITS TYPICAL PATTERNS:

In pre-barrage era where lands were at a higher level than water in the canals pumping had to be done by Persian wheels during the whole season. Considering labour and animal time it was highly un-economical, but animals grazed on waste government lands and men had no alternative occupation so this was the best one could do to have some income rather

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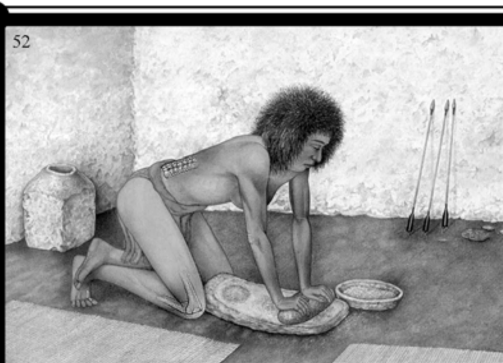

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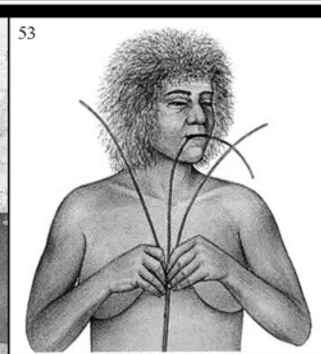

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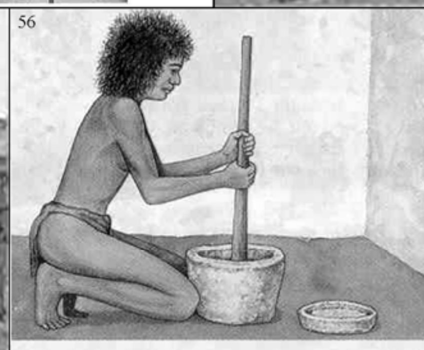

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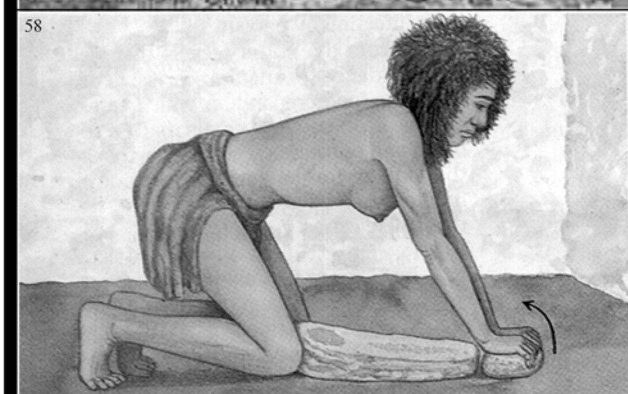

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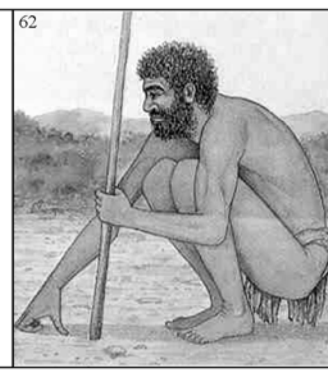

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EVERYDAY LIFE

052. Women's dragger and typical bone damage Quren and pestle for grinding grain
053. spliting Reeds for basketry
054. weaving basketry
055. Plant Gathering
056. Using mortar and pestle
057. using quern
058. Woman husking grains
059. Woman separating butter from yogurt. Yogurt was mixed with plentiful water to make butter float on it. After separating butter the remains were used as a drink like milk.
060. Women carring 2 jars of water
061. Squatting at rest
062. Cereal and pulse cultivation
063. Sheep and goat husbandry

than none.

Where the canal water level was higher than surrounding lands during the peak inundation season but not at the times of sowing the crops or its final stages maturing Persian wheels were used during the low canal level.

Where canal level was higher than surrounding land during growing season of four to five months a year summer crop could easily be raised during inundation season, but there also were areas sufficiently above the water level and in this case too water had to be lifted.

The above three methods of irrigation applied only to Kharif or summer crops raised between June and October/November, but in some areas winter irrigation too was resorted to by following methods:

The Indus had a western branch called the Western Nara. At various times of history it started from north of Kashmore and then south of it. In the beginning of nineteenth century it started near Sukkur and finally ended in the Manchar Lake from where it went by Aral canal to the Indus again. Nara was a perennial canal and depending on the levels of adjoining lands it supplied water by gravity or by lift with Persian wheels. It carried substantial discharges to be navigable year around and therefore played an important role in shipping and the prosperity of Larkana and Dadu districts. This branch of the Indus was responsible for Rabi (winter) cultivation as well as perennial irrigated crops some of which were fruit crops like mango, lemon, orange, zizyphus mauritania or ber etc., winter vegetables of all categories, tobacco, Bhang (Hibiscus), wheat, barley, oats and winter oil seeds.

Besides the Manchar Lake, Sindh had number of lakes formed mostly by the old beds of the River Indus or Hakra. These were filled in summer and water was lifted from them in winter for Rabi as well as perennial crops. Lakes also provided a number of exotic root crops and vegetables.

There was another type of irrigation from the River Indus called Sailabi. In this type of cropping system land was flooded in summer and winter crops were raised on preserved moisture. Such areas were natural depressions or lake beds (including Manchar), which were used for winter crops when water from them was drained out for other purposes or evaporated. The riverine areas flooded in summer were and still are also utilised for Sailabi cultivation. When done deliberately by the man it could be categorised a separate kind of irrigation.

Winter crops called Dubaris (second crop) is another innovation in the rice areas where ground is fully saturated with water by early August. After the harvest of rice crop in October-November water table still is about one or two feet deep and surface is wet. A Dubari crop of oil seeds, peas, beans, wheat and barley is raised on it. The selection of crops is governed by rate of fall of water table to eight feet. If it occurs at end February peas and oil seeds are raised and if it is sustained until end March wheat, barley and horse beans are grown.

The first of the two methods goes back to Amrian times and can be considered as rudimentary irrigation. The second method (Dubari) is post-Mohenjo Daro development and probably started in Jhukar times after 1650 BC with introduction of rice in Sindh.

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064. 10,000 BC to present times: Ancient quern and saddles evalved by food gathering tribes
065. 2300 - 1700 BC: Saddle-quern and muller stone found from Mohenjo Daro

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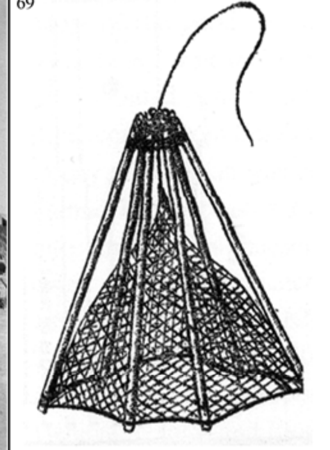

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FISHING, FISHERMEN HOUSES AND FISHING TOOLS

066. Fishing with net called Kurhi
067. Fishing from a boat.
068. Fishermen's Village near Sandspit.
069. Dip net or kurhi of Sindh for individual fisherman, consisting of 6-8 wooden rods tied around a wooden ring at the top folded like an umbrella and with net forming a cone inside the ring from bottom to top ring, opended and pulled by string at the top and kept over fish in shallow waters.by releasing string fish is trapped and is picked up by hand. Height 1 to 2 metres.
070. Pala fishermen on the Indus 1876.
071. Palla fishing on the Indus in 1876. He used large earthen pot called Mutt in Sindhi with a mouth on which he keeps his stomach, while floating or swimming in the Indus. His net called Samboohi has some 4.5 to 5 m long pole, discussed in Sindh Gazetteer 1876. (Illustrated London News, 19th February 1876).
072. Pala fish the river shad (Tenulosa illisha)
073. Microlithic fishing tools 10,000 BC to 2500 BC.
074. Fisherman using large clay pot with mouth at the top for floating while fishing and sorting fish in it. The mouth of pot covered with belly.

CHAPTER 4

DESPOTISM IN SINDH: A NATURAL CONSEQUENCE OF IRRIGATION; A COMMON FEATURE IN ALL IRRIGATED ARID LANDS OF THE NILE, THE TIGRIS-EUPHRATES, THE HWANG HO, THE MESO-AMERICA AND THE INDUS VALLEY

Despotism cannot occur within the strong centres of rain-fed agriculture as in such areas it does not require organisation for building and maintaining irrigational canals required for water deficient landscape. Irrigation in arid zones ultimately would lead to despotic control by government or government approved functionaries. Despotic control immediately ceases when property based management gets into such areas with advanced technology and capital.

Irrigation in water deficient landscape has shown advantages even when a few generations of benevolent rulers have organised the irrigation works well. This increased population and also produced enough surplus food, which resulted into the urban growth. This in turn supported governmental aspirations of making conquests and created empires. Planted agriculture started in the Crescent (southern Turkey and Lebanon, Syria and Jordon) around 7,000 BC as it did at Mehrgarh in the Indus valley almost simultaneously. This invention spread from its origins across Asia and Europe. It started in Egypt and Mesopotamia later than in Sindh if Mehrgarh is considered part of Sindh up to 1739 AD. In the Indus flood plains men needed a new and further technology to evolve and replace forests with cultivated crops.

They had been growing wheat in areas of Mediterranean climatic (winter rains) zones of the present Balochistan; at Mehrgarh since 6,500 BC or even 500 years earlier. They had per chance found out that after the inundation when river receded in autumn on the preserved moisture of silted land wheat crop could be grown successfully. By this time (4,000 BC) dog, pig, goat, sheep, cattle and onager had already been domesticated. Fishing had already been practised by means of hooks, harpoons, nets and traps. Hand made pottery was being baked in the kilns. The wheel made pottery was on its way to be introduced.

These people, the early Neolithics, settled in the Indus plains at Amri and possibly at a number of similar villages. Initially they depended only on Rabi crops grown in the above manner. The exact date cannot be ascertained but in all probability in a millennium or so they hit up canal irrigation. Initially it was use of spring water, which by itself flowed out in form of a stream and later on by use of Wahur, Dhoro and Dhori as discussed in chapter 8. The method must have been to lead water from some lake or river channel into a low lying land. Settlements invariably were built on the elevated areas to save them from flooding during the inundation seasons.

Hunting-food-gathering tribes (13,000 to 5,000 BC) had to work for food day-after-day with no planning for future. Development of agriculture was based on planning for future; not only stocking food until incoming crop, but for full twenty-four months if the next year’s crop failed due to flood or drought. To produce surplus food more population was required and to feed this increased population more land had to be reclaimed. In article “Sindh - its food resources since antiquity" it is shown that Sindh had capacity to support hunting population of 100,000 around 7,000 BC. Primitive agriculture must give rise to more population and additional population would need more land. With well planned agriculture of early rulers such as Kalhoras the Sindh province could easily have 2.1 million acres under agriculture and thereby support three million people in rural Sindh. It must be emphasised that Kalhoras' irrigation and agriculture

were as primitive as Mohenjo Daro agriculture. Irrigated agriculture would need lot of cooperation and more of it is needed if canals become longer in length, greater in their capacity and larger areas they command. The annual clearance of water courses alone would take away most of the free days of farmers. Even volunteered operations would need a leader or an authority to work under. Such authority was easily developed by cooperating farmers on a canal. The leader first assumed the role of water course or canal management to get water and thereby cultivate his and other farmers' lands without accepting fully the subordination of the regulation laid by this leader. Larger the canal the leader enforced his regulations of distributing water on basis of probable share cropping and became despot. In times he extended his jurisdiction over a number of canals and even to the new land to be cultivated. Even the most civilised governments in Sindh in past four thousand years had to accept him as a coordinator at canal or watercourse level. Many injunctions were formulated to uphold his authority. The central authority in irrigational society then had to be despotic in nature. This is true of all irrigational societies; not only in the irrigated Sindh and Punjab but also in Egypt, Mesopotamia, Hwang Ho valley and Meso-America.

Information on Sindh's history so far collected reveals that the mature Indus culture (2300 BC – 1700 AD) Vahlika, Rai, Brahman, Habari, Soomra, Samma, Kalhora and Talpur dynasties must have been the consequence of such agricultural management and at least for the past 3,600 years of the canal irrigational system. The short lived rule of Kalhoras was again the outcome of well managed irrigation system and could be equated by the British efforts after fifty years of their long struggle with the Indus and its behaviour.

It was in the arid zones that the agricultural returns were the highest before advent of modern technology. It is on account of this that the arid zones were centres of civilisations until the industrial and technological advancement of past two centuries. The civilisations in arid zones rose and fell with the irrigational works and their destruction was caused by natural consequences i.e., climatic changes leading to drought, floods and changes in the courses of the rivers. These changes caused destruction of irrigational works, cultivated lands and settlements, resulting in shifting of population to other parts of the country, famines and reduction of population almost to half within a decade or two. Once irrigational system was restored population easily doubled in half a century. Protection of urban centres and some villages by embankments was being practised for centuries in Sindh, but the construction of flood protective embankments by the British was meant to protect not only the settlements and irrigational works but also the land under cultivation. Today such works exist in all the valleys of the major rivers of irrigated arid countries. Though exact patterns and dimensions of government regulations were prevalent in Mesopotamia, China, Egypt and Meso-America they must have been in force in Sindh from the Jhukar times i.e., 1650 BC, but sufficient data about compulsory participation of every adult male in digging and cleaning of canals and threats of punishments to evade these duties are only available from other countries, specially Mesopotamia and Egypt. To tax the farmer according to area actually under cultivation the beginnings of geometry are traceable in Egypt as stated by Herodotus long before Euclid's 'Elements'.

Unlimited control over the labour power of the subjects enabled rulers of the Indus, Sumer, Babylon, Egypt and Hwang Ho valleys to build spectacular cities, palaces, gardens, grain stores and tombs. The irrigational state has despotic leadership and despotic government is invariably stronger than the society it rules. Government's collecting land revenue over a vast irrigated tract and maintaining canals meant efficient maintenance of records. Need of such records gave rise to invention of writing, arithmetic and weight system as multiples of two as well as the decimal system. Once these masters of the society were forced to become record keepers they easily became great organisers and as a consequence builders of urban as well as irrigational works.

In the third century BC Magasthenes found Asoka's officials charged with the task of measuring fields, counting people and allocating irrigation water to various users by means of orifices and other measuring devices. Arthasastra of Chanakya (Kautilya) also mentions the canal officials. This could not have arisen overnight without experience gained over many past millenniums. The canal officer of Abbasids had 10,000 men at Merv and assumed powers of a district police chief. Abbasids may have tried similar set up in Sindh, but with failure as discussed in chapter 22. In order to keep control over the flow of taxes the authority had to be well informed of irrigational network and taxes arising as consequence of it. An intelligence as well as postal system must therefore have operated from Amrian times. From Achaemenians onwards (519 BC) records of such system and even rudimentary Morse code

telegraphy being under operation are available. In connection with embezzlement by the taxation officials as well as maintenance of irrigation system itself, Arthasastra states that an official who deals with king's revenues invariably is tempted to embezzle. So government must use skilled spies and king may squeeze them after they have drunk themselves fat. He should transfer them from one job to another so that they vomit what they have devoured.

The irrigational regimes are frequently theocratic because society, which provides unique opportunity for growth of despotic governmental machinery, leaves no room for an independent position by attaching to themselves, in one form or other, the symbols of Supreme Religious Authority. Inca kings became descendents of the Sun; Pharaoh became son of god or god himself; Mesopotamian kings were quasi-divine; Umayyad and Abbasid emperors titled themselves as Khalifas and appointed interpreters of religious code - the Muftis. In the South Asia from Asoka onwards kings became champions of one or other religion and combined political and religious leadership. The Indus civilisation probably had priest-king, though not proved archaeologically. Under Muslim rule in India persons directly dependent on the sovereigns administered mosques and holy shrines. Under Sammas of Sindh religious heads organised opposition to Arghoon aggression. Even after Sammas' overthrow they continued resistance against Arghoons in the hope of restoring them back.

Kalhoras were religious Pirs and called themselves Fakirs. The religious endowments or Waqfs, which provided support to the mosques, were usually administered by the state. In an irrigational society such measures prevented the Islamic clergy becoming independent of state. This is also the reason that in an irrigated society the religion invariably has placed itself within the authority of the state without preventing itself from domination of the state. The table below shows how successfully the rulers/leaders imposed their religion on the ruled who adopted their religion. The British were successful in imposing law in the land, which was secular and under strong administration they enforced secularism bypassing the religious domination. The Table below gives religions of the ruled and the rulers from the Indus civilisation to 1947 AD.

Dynasty or era	**Religion of rulers**	**Religion of majority of population in Sindh**
Mohenjo Daro	Paganism	Paganism
Vedic people	Vedic	Vedic superimposed on + Mohenjo Daro religion, which is presented in the form of Upanishads.
Achaemenians	Zoroastrianism, but did not interfere in local religion	Jainism (their rule was short lived)
Alexander	Paganism	Jainism
Mauryans	Buddhism	Buddhism
Bactrian Greeks, Scythians, Parthians, Early Kushans	Buddhism	Buddhism
Later Kushans	Hinduism	Buddhism (their rule was short lived)
Vahlikas Rais (Sudras)	Buddhism	Buddhism
Brahmans	Hinduism, but totally tolerated Buddhism	Buddhism
Arabs	Islam	Buddhism
Soomras	Ismailism (Muslim sect)	Ismailism
Sammas	Sunism (Muslim sect)	Sunism
Arghoons, Tarkhans, Mughals	Sunism (Muslim sect)	Sunism
Kalhoras	Sunism (Muslim sect)	Sunism
Talpurs	Shiite (Muslim sect)	Shiite
British	Secularism	Islam/Hinduism

For their dates of rule see chapter 2.

RELIGIOUS POSTURES, STRUCTURES AND OBJECTS

Due to lack of excavations of Soomra ruined cities, little is known of religious architecture. Since Buddhism, Hinduism and Islam co-existed up to the end of 13th century, construction ideas came from stupas originally built in sixth to seventh centuries. As only two mosques at Banbhore and Mansura-Brahmanabad are known and some tombs of the twelfth and thirteenth century Muslims are existent, there is limited scope in time scale to throw light on religious structures of Muslims in Soomra Sindh. Two such tombs called Suhagin and Duhagin constructed probably in thirteenth or early fourteenth century show heavy Buddhist influence. Suhagin and Duhagin graves are not those of married and widowed women as the word implies, but of some noblemen of Alore (which city survived up to mid-thirteenth century) and Bakhar in northern Sindh, which area came under the rule of Qabacha and later on Altatmash from 1217-1236 AD. The hemispherical dome came from Iran and the central Asia, but these two domes at Alore are raised over four-corner pillars having bell shaped capitals, essentially a Buddhist innovation. Sculptured or cut bricks are used to produce pseudo-Kufic inscriptions. No attempt is made to read them. Sculptured, moulded and cut bricks were common in Sindh during the era. Panels on outer walls are also not copy of any other monument in South Asia, except that in Sibi (Balochistan), which then was part of Sindh. Decoration also appears to be local. It seems that Buddhist-Hindu architects have attempted to produce Muslim monuments with outside resembling popular Islamic architecture of era. So called demons from Brahmanabad-Mansura may be deities of some group of non-Muslim Sindhis. Deity with snake around the neck appears to be Siva. Twentieth century Siva, in wood from Shikarpur Sindh, in Sindh Museum looks like 13th century brass die and has moustaches. Siva is also shown in Yogic posture.

ORIGIN OF YOGIC POSTURE

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075. Mohenjo Daro seal shows Yogic posture of three-faced deity with horned head gera, which has tamed all kinds of animals. It has been identified with Siva of Mahisa.
Buddha's posture is similar too.
076. Also from Mohenjo Daro shows three-faced deity in Yogic posture.
077 & 078. Buddha from Mirpurkhas stupa in Yogic posture. (Cousens).
079. Siva in Yogic posture and snake around his neck. (Karam Chand Dodani).
080. Rock-Cut Buddha from nothern central China.
081. Mahavira in Yogic posture.

The government in an irrigated society puts a number of demands on the cultivators including conscription for war services. The government asks the Jagirdars, Mansabdars and Seminaries to supply soldiers along with arms. Even the British did the same in World War-I and II. For this reason alone they had tactfully kept the village chief in good humour accompanied by fear. Young men ignorant of warfare and use of arms depending on their finding ease with which they could govern such bravery and chivalry are collected. Such an army is invariably defeated. This is main reason for frequent occupation of irrigated valleys by outsiders who permanently settle in such lands and in two to three generations lose their vigour and tactics of warfare, draw the army from cultivators and are in turn defeated and succeeded by others. This accounts for average life-expectancy of seventy years for various dynasties of Sindh shown in table in chapter 2. This pattern has followed in other irrigated countries too.

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PHILOSOPHERS AND WARRIORS

082. Confucius, Chinese moral philosopher, 551 BC - 479 BC.
083. Zoroaster, 628 BC - 551 BC.
084. Lao Tzu, Late 6th early fifth century BC.
085. Bodhisattva of the Ghandara School, India. 1st or 2nd century AD.
086. Genghis Khan, 1162 - 1227 AD.
087. Nadir Shah
088. Cyrus the great, 590 BC - 529 BC.

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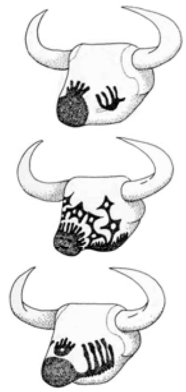

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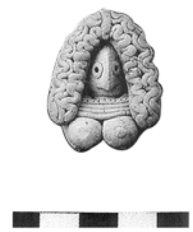

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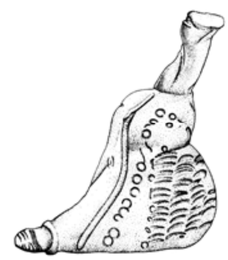

105

MOTHER GODGESSES AND DEITIES

089. Mother Goddess 3000-2000 BC
090. (Mother Goddess) terracotta figurines, period VII (MG)
091. Bull heads (7500 BC)
092. Terracotta Bull from Mohen jo Daro (2300-1700 BC)
093. (Mother Goddess) upper part of a figurine from a trash deposit in loc, period VIIB/C (MG)
094. (Mother Goddess) female figurine from sector MR F, period VI/VII (MG)
095. (Mother Goddess) terracotta figurines, period VII (MG)
096. (Mother Goddess) terracotta figurines, period VII (MG)
097. (Mother Goddess) body of female, period VIIB/C (MG)
098. (Mother Goddess) female figurines from sector MR F,period VI/VII (MG)
099. (Mother Goddess) female figurines from sector MR F,period VI/VII (MG)
100. (Mother Goddess) female figurine from sector MR E,period VI/VII (MG)
101. Venus' of Tepe Sarab, Neolithic period, about 6000 BC
102. The Venus de Milo. C. 100 BC.
103. The Capitoline Venus. 4th century BC.
104. Mother goddess (Iran) similar in Mehrgarh, 7000-5500 BC
105. (Mother Goddess) terracotta figurine, period VIII (MG)

CHAPTER 5

SOCIAL AND ECONOMIC STATUS OF FARMER IN AN IRRIGATED SOCIETY

The general pattern shown by status and life pattern of the government or farmers in irrigated society shows that:

- A peasant family of five could grow enough grains by primitive methods on five acre farm to feed themselves for a year if they could keep all the harvest. But this they can not do because they have to pay fifty percent or more as share to the land owner, who is responsible for management and supply of irrigation water, and the burden of labour for excavation and maintenance of irrigational system is on the cultivator. The British gradually freed the farmer form this forced labour.
- To supplement their income they worked for others at exploitive wage rates during free time - for slight additional income or food. This is true for Sindh even today.
- Farmer is considered socially inferior in the society and only slightly above the untouchables. The word "Vaisha" in the Hindu caste system applies to owner-cultivator or Seminary and not to the tenant-cultivator. All along he has inferior status socially, politically and economically and also legally at least in certain societies, which in Sindh exploit him in the name of jirga, elders' decision, spiritual leader (Pir) etc. The Sindhi word "Hari" (tenant-cultivator) derived from Sanskrit means untouchable. Brahmans categorised farmers as untouchables.
- Considered legally free at least since British conquest of Sindh and not bound to work as statutory labour since 1856 AD. Although in the past two decades there has been social and political awakening among the farmers, yet they are socially inferior, poor, semi-literature or illiterate, backward and almost isolated from social and cultural life, which the other classes of people in Pakistan ordinarily enjoy today.
- After study of life of peasants in different irrigated areas in Indo-Gangetic plains, Hwang-Ho, Meso-America, Egypt and Mesopotamia valleys where different religions and traditions namely Islam, Hinduism, Christianity and Buddhism prevail, which are so different from each other, it is observed that peasants in all these areas surprisingly follow similar practices, namely:

a) Inheritance of land through the male line.
b) Joint family where grandparents and grandchildren live under the same roof and work together.
c) Religious practices, which are similar i.e., visit to shrines of holy men, regard for living holy men and superstitions.
d) Similar social trends, which include suspiciousness, superstition, jealousy and unthriftiness.
e) Part time agriculturists like village traders, pottery makers, weavers, carpenters and black-smiths also fall in the same category as the tenant-farmers and in Sindh they are definitely considered inferior - only slightly better than Sudras or sweepers.
f) Household farms usually do not provide enough income for the labour of the cultivator in spite of hard work so he and his whole family engages in other part time jobs including cattle raising and rearing and making of handicrafts etc.
g) They do not use adequate modern agricultural equipment, chemicals and hand tools and their methods of production invariably are inefficient.
h) They rarely are permitted to participate in the national decision making.
i) Their produce is invariably put under price control by the government and raised only when feared or actually demonstrated that they would give up raising that particular commodity in future. This is true for Pakistan since the beginning.
j) They suffer through insecurity of life and property.

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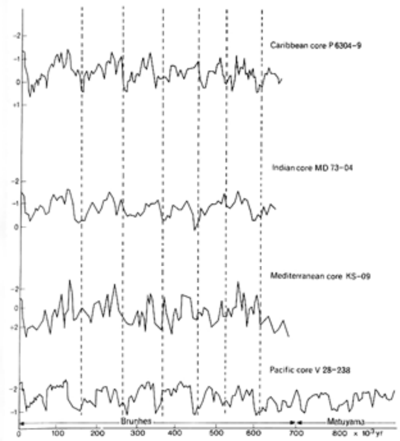

Oxygen-18 variations of planktonic foraminifera as function of time in deep-sea cores raised from the Caribbean sea, the Indian Ocean, the Mediterranean Sea (C. Grazzini, unpublished) and the Pacific Ocean. Odd numbers represent warm isotopic stages defined by Emiliani.

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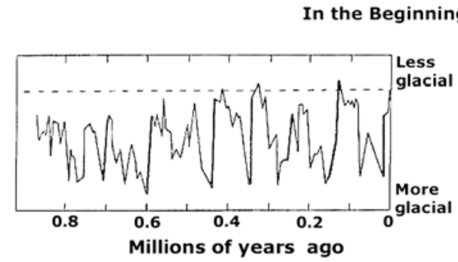
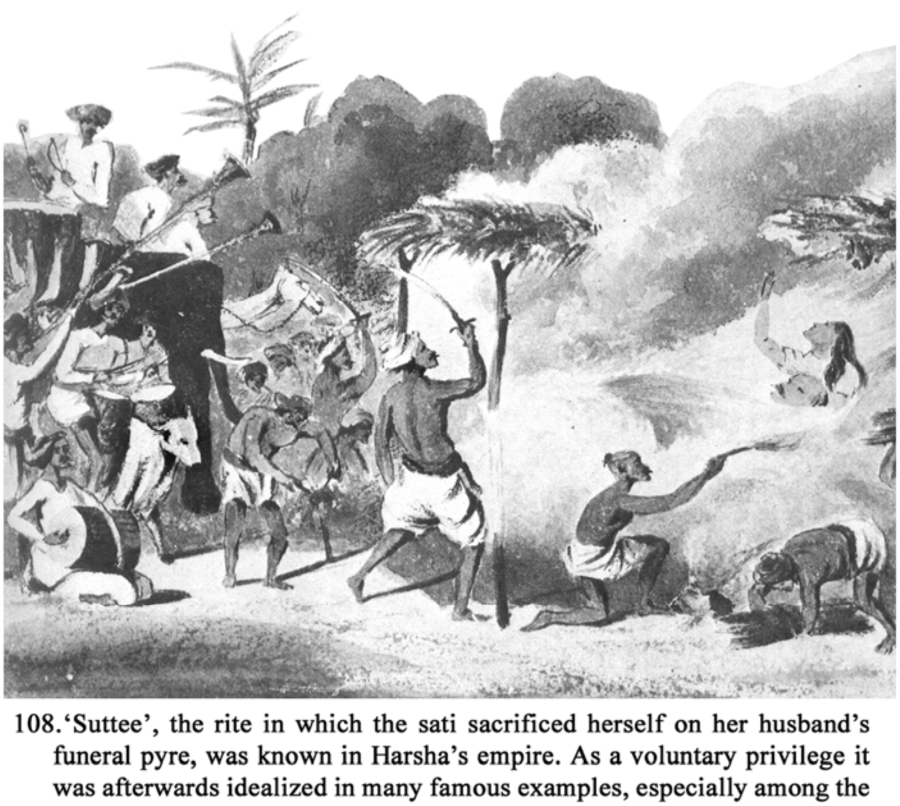


Global ice volumes of the past million years, based on O-18/O-16 ration in deep-sea cores. heavy lines show times of warming from each of the seven ice ages known within the past 700,000 years. the dashed horizontal line shows that times with as little ice as present have been rare and brief. Adapted from National Research Council,1975, p.130.

SATTI AND FACTORS INFLUENCING CLIMATE



108. 'Suttee', the rite in which the sati sacrificed herself on her husband's funeral pyre, was known in Harsha's empire. As a voluntary privilege it was afterwards idealized in many famous examples, especially among the Rajputs. This drawing was made some years before its suppression in 1829.

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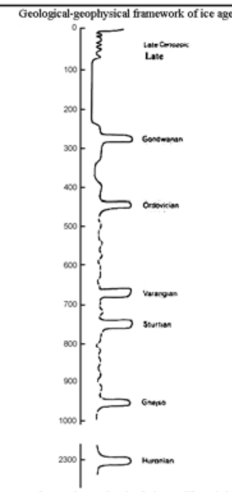

Ice ages through geological time. The right hand side of the curve corresponds to periods of major ice sheet formation with each period including several glacial and interglacial stages. The left hand side of the graph corresponds to periods with no known glaciation, with intermediate position indicating the possible extent of mountain glaciation.

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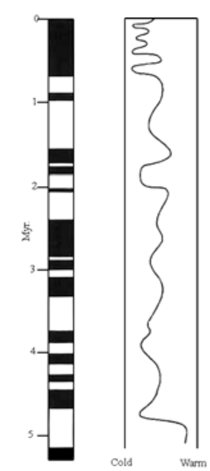


Generalised temperature trends for the past 5 Myr. The age and polurity scale (Tarling & Mitchell, 1976) has been combined with curves of Theyer (1972) and Blank & Margollis (1975). It is emphasised that these are only generalised trends which cannot yet be adequantely quantified.

k) Their income from the land as well as from additional labour and occupation can hardly fetch them the required per capita ration of calories. Having suffered, thus genetically, they become small in size because under such circumstances the most likely to survive would be those with low requirement of calories.

l) Their food is most unique among the basic human adaptations that it would contain almost no animal protein most of the time. They subsist on plant proteins, which rarely contain all the 21 amino acid available in animal protein. The human body adapts to protein deficiency by delay in growth of skeleton and slower maturation.

m) In days of despotic overlordship the farmers are not allowed to sell their produce direct, sell their beasts or get their daughters and sons married without getting permission of the Sindh's Seminary even to this day.

n) Many of the children they produce die prematurely due to lack of health services.

o) There is usually uniformity of dress as well as housing in the farming villages. Up to 1947 AD village women of farming community wore red shirt, Dopatta and Sussi-shalwar while men wore black or blue 'Gode', coloured shirt and turban of cheapest white cloth. Ajrak was wrapped around the upper part of body in winter. Naked feet for both men and women were not unusual except when ploughing the field or going elsewhere.

p) They consider large families advantageous. It has been found that large family lives under the same roof from grandparents to grandchildren because of cooperative nature of work, earning better living and to be able to gain better social status in the rural community. Larger number of children is also an insurance against high mortality rate among children.

q) Large number of children does not represent the crushing financial burden to the peasant. They keep birds and animals away from the crops, cut grass, collect fire wood and carry food to the parents in the field. However, the whole family has to work too hard as children's productivity is much lower than cost of their upkeep. In peasant families the birth control campaigns have been ridiculed and doomed to be failure unless their income is raised by government's artificial price control.

r) Because of jealousy among the farming community if anybody improves economically and by hard work becomes prosperous the others in the society encourage him to throw elaborate feasts on various occasions and if there is no such occasion in near future a Khairat feast (feast in name of Allah) is encouraged and whatever little saving was there with the unfortunate family is made to drain down into the stomachs of the villagers with superstitious hope that this is a loan, which God will repay by making family prosperous.

s) Handicraft making usually resorted to in spare time to supplement the family income is not able to compete with machine made goods produced at a lower cost and hardly repays fraction of actual labour.

Since every member of family including girls contribute to the family economy in a peasant society four kinds of marriages of girls are most common:

(i) Exchange of girls i.e., a girl is married to another family in return for a girl from that family to be brought back as bride for any of the boys. Thus total strength of family is maintained constant.

(ii) A girl is married to the first cousin usually under the same roof. Even if they live separately it is considered no loss in terms of total strength of family.

(iii) Sometimes a girl is married on the condition that son-in-law will come and stay with bride's family forever.

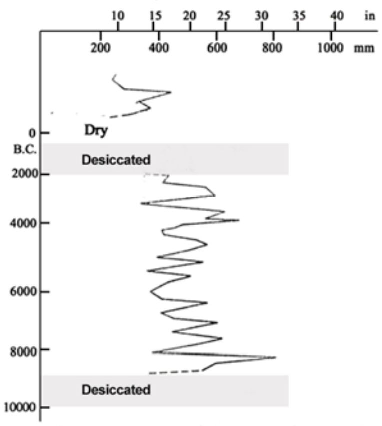
(iv) A large family having more girls than boys allows girls to be married without exchange of girls so to say on loan subject to condition that a girl born in the groom's family or a girl produced by this couple will be returned years later to the family loaning the present bride.

These are bases of rural poverty on which foundations of urban cities, great empires and civilisations were erected.

FACTORS INFLUENCING CLIMATE

111

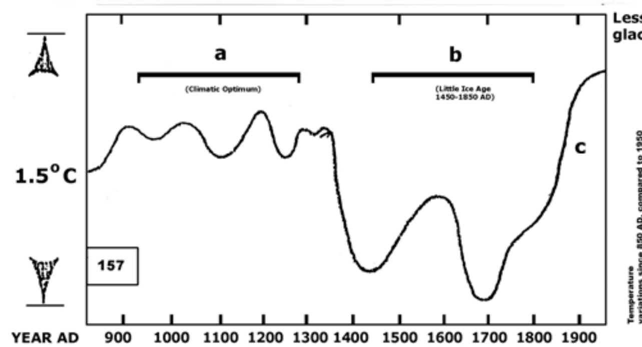
RAINFALL VARIATION IN SINDH
9,000 TO 2000 BC



Amount of summer monsoon rainfall, calculated from pollen date, Lunkaransar, Rajasthan, India. Adapted from Bryson, 1975a; based on Singh, 1971.

112

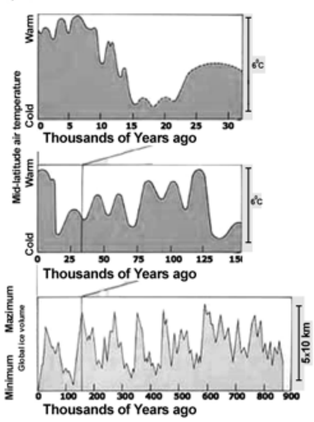
LITTLE CLIMATIC OPTIMUM 900-1200 AD AND LITTLE ICE AGE 1430-1850 AD.



this curve of Bryson shows present temprature higher than those around 900-1200 AD. Actually they were higher than the present on callacted as........

113

AVERAGE EARTH TEMPRATURE DURING PAST 900,000 YEARS.



Source Burenhyle, Goran (ed). The humans 1994, Harpers, San Francisco. The figure 11 shows that climate in no hundred thousand years. Since 900,000 years ago was the same. There were continuous fluctuations. The coldest tie probably was 130,000 to 140,000 years ago.
Figure 11 (b) shows fluctuation in temperature, during past 150,000 years ago and of this the coldest period was abolut 18,000 years ago.
Figure 11 (c) show start of warming around 12,000 years ago (20,000 BC), followed by two surges of cold and rise of temperature after 13,000 BC (15,000 years ago), with surges of rise and fall and present day temperature lower than they were in 7,500 BC or 4,000 BC.
From.......................

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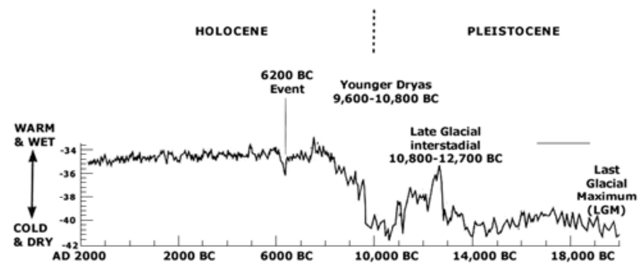
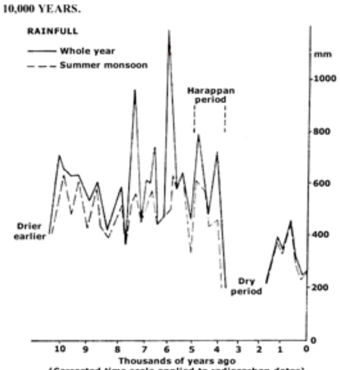
END OF LAST ICE AGE 20,000 BC TO THE PRESENT



This is the latest figure of climate based on ratio of 160 and 180 of oxygen as investigated from Greenland. As 018 content of air at any time will be the same through out the world and is variable with temperatures prevailing at any tiem.
The following are important conclusion:
The coldest time of before 20,000 BC when warming started.
From 14000 BC it started warming and 12,700-10,800 wasd warm period called Late Glacial Inteerstadial.
From 10,800-9,800 started cooling and 9,800 was as cold as 20,000 BC. This peirod is called Younger Dryas.
From 9,600 BC it started warming and it is warm since then.
,500 BC was warmest event since 20,000 BC.
At 6,200 BC there was dip in temperatures for couple of centuries but then climate became normal.
Another warm period was around 5,000 BC.
Around 21,000 BC temperatures dropped, but recovered before 1,000 BC for some centuries.
From 800 to 1,200 AD they were as warm as around 3,000-2,100 BC.
Since 1,200 BC they are falling with dip between 1,450-1,800 AD.
Friom 10,000 BC todate it is called Holocene and before that Pleistocene.

115

ESTIMATED VARIATIONS OF THE RAINFALL IN WESTERN RAJASTHAN CLOSE TO SINDH OVER LAST 10,000 YEARS.



From Lunkaransar lake (about 250km east of Sindh border on 28 - 30 N and 37 - 45'E)
levels and pollen analysis based on work of G.Singh and adapted by Bryson. Reproduced from Lamb, 1982, p.123.

116

NOTHERN HEMISPHERE TEMPRATURES OF THE PAST 100 YEARS.

Adapted from National Research Council, 1975,p.130; based on Mitchell, 1963. and taken from Bryson 1977 p.130.

CHAPTER 6

THE CLIMATIC CHANGES AND CULTURAL DEVELOPMENTS IN SINDH AS WELL AS IN THE INDIAN DESERT; 9,000-1500 BC

The studies into climate of Thar desert close to Sindh have been based on the level of water in four inland salt water lakes in Rajasthan namely; Sambhar (27^o N, 75^o E), Didwan (27^o-20’ N, 74^o-35’ E), Lunkaransar (28^o-30’ N, 75^o- 45’ E) and Pushkar (26^o-29’ N, 74^o-33’ E) - the first two in the present semi-arid belt (rain fall between 25 to 50 cm), the third in the arid zone (less than 25 cm rain fall) and the last in semi-humid belt (rain fall 50-60 cm). The studies showed that:

- Before 9,000 BC there was very dry climate.
- 9,000 - 8,500 BC the climate moved form very dry to beginning of low wet period.
- 8,500 - 7,000 BC climate changed to medium wet.
- 7,500 - 4,000 BC high wet climate.
- 4,000 - 2,000 BC high wet climate.
- 2,000 - 1,750 BC very low wet climate.
- 1,750 - 900 BC hyper dry climate.
- 900 - 400 BC dry climate.
- 400 - 650 AD low dry climate.

The present arid, semi-arid and semi-humid zones of Thar Desert were one step higher i.e. semi-arid, semi-humid and humid zones respectively. This way the whole of desert zone is called Nara (desert of Sukkur and Khairpur districts and Khipro taluka).

Wet climate was an advantage to the man in domestication of cattle and ultimately led to domestication of agricultural crops in Thar, Kohistan, as far as Sibi and central Sindh. Bosi or Dubari cultivation thrived on preserved moisture in Jacobabad, Larkana and Shikarpur districts and Mehar and Khairpur talukas of Dadu district. This otherwise is a rice area where water is applied between June and September. By first August the latest rising water table reaches the ground level, it starts falling gradually by October and in May it is already eight to twelve feet below ground level. "Dubari" grown on this land consists of peas, beans (Channa), oil seeds, barley and wheat. The first is harvested in February, the next two in March and wheat is harvested in April. Not every area is would be difficult unless rice is grown on it in summer and water table maintained at ground level until end of September. This means that rudimentary summer irrigation must have been practised if vast areas were to be put under winter crop. It has already been discussed that the man in Sindh allowed depressions in the flood plains of the Indus to be filled in the inundation season and drained them in autumn to plant winter wheat since five-thousand-and-five-hundred years ago. The only exception would be riverine areas, which remain under flood water until September and are drained automatically. Possibility of such lakes existed along the Sindh hollow or possibly Makhi-Chotiari system of lakes and other small depressions specially in the lower Sindh, but scope was limited looking to the extent and size of the Indus sites.

FACTORS INFLUENCING CLIMATE

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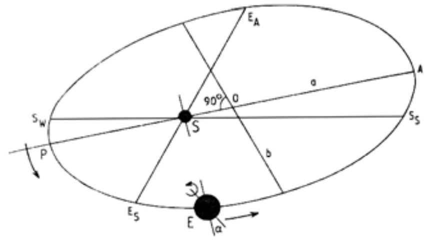
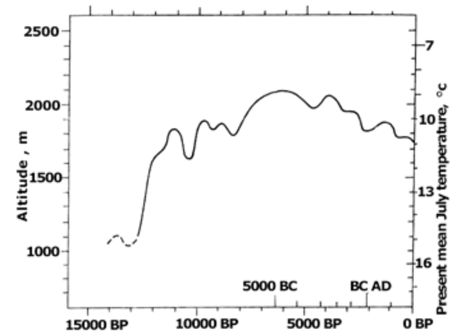
ANOTHER FIGURE ILLUSTRATING THE ORBIT OF EARTH AROUND THE SUN.



The Earth's orbit and iteme which undergo long-term cyclic veriations. In the sketch the orbit is seen from a slanting angle outside its plane: so the angle between the major and minor axes of the ellipse, a and b, does not appear as a right angle because of the perspective. the sun S is at one focus of the ellipse, and the ratio of its distance from the centre of the ellipse OS to SP measures the eccentricity e=OS/OP. Short lines are drawn through the sun. S and the Earth E vertical to the palne of the orbit (the 'ecliptic'). the angle a between this vertical and the Earth's polar exis is called the obliquity. The present seasonal positions of the Earth in its orbit at the winter solstice, S_w the spring equinox E_s, the summer solstice S_s and the autumn equinox E_A are marked. The two other points marked are P where the Earth is at perihelion (i.e.farthest from the sun). The seasonal points (shown joined by lines which are always at right angles to each other) slowly precess around the orbit so that the season at which the Earth is nearest to or farthest from the sun slowly changes, taking about 20,000 years to complete the circuit. The winter solstice S_w is at present slowly getting farther from P. (from H.H Lamb Climate, History and Modern world, 1982 P.60)

118

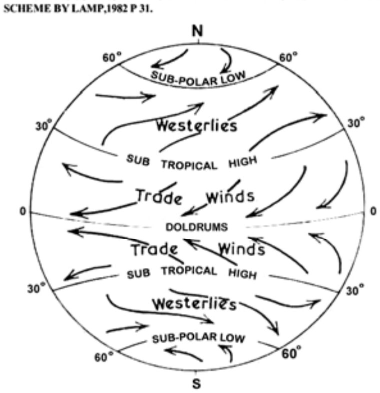
AVERAGE HEIGHT OF THE UPPER TREE LINE ON THE MOUNTAINS IN TEMPERTE LATITUDES SINCE THE LAST ICE AGE.



(From work by V.Margraf. Reproduced by Lamb.1982)

119

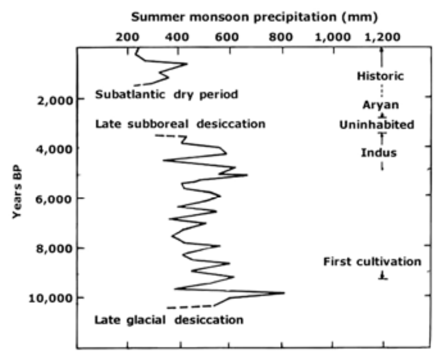
PREVAILING SURFACE WINDS IN DIFFERENT LATITUDES AN IDEALIZED SCHEME BY LAMP,1982 P 31.



Earth moves west to east and trade within 0-3 N and S move east to west. Westerlies move west to east ie anticlockwise in Northern Homisphere as seen from The noth pole and clockwise in the Southern Hemisphere as seen from South pole. They move in a appositedirection of Westerlies near the poles. How However pattern is not exactly as in the above diagram, as land and water massas change the exact divisions.

120

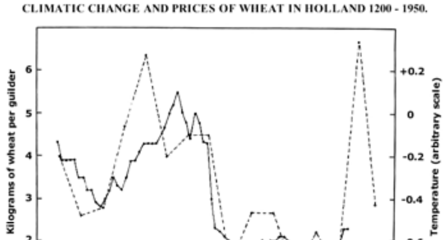
RAINFALL IN WESTERN RAJASTHAN IN THE PAST 10,000 YEARS AS COMPARED TO THE PRESENT.



Tentative reconstruction of the summer monsoon rainfall in Rajasthan over the past 10, 800 years, based on fossil pollen accumulated in a lake. Singh et al.(1972) converted to climatic profiles by the transfer equation method of webb & Bryson (1972).
The lake contained fresh water until shortly before it dried up about 3,500 years Adapted from Pittock 1978 p.323. there is continuous variation of Rainfall.

121

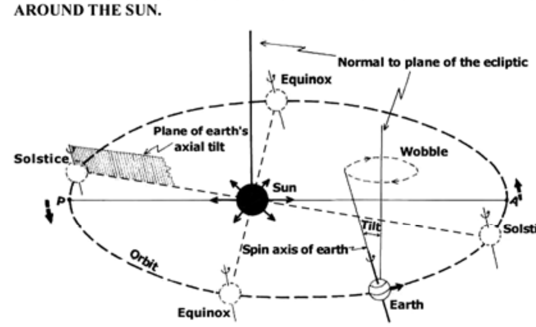
CLIMATIC CHANGE AND PRICES OF WHEAT IN HOLLAND 1200 - 1950.



Amont of wheat that could be bough for one Dutch guilder from 1200 - 1950 Temperature is indicated by ---- ● ---- kilograms/guilder is shown by —— ● ——
When temperatures were high, production was more and wheat was cheap. More wheat then could be purchase per guilder. Here high production between 1400 - 1450 and prices appear doubt ful. Adapted from PiHock, 1978.

122

PYSICAL BASIS OF CLIMATE GEOMETRY OF MOVEMENT OF EARTH AROUND THE SUN.



Geometry of sun earth system. The or this orbit is a large ellipse with major axis A and P. Arrow show direction of its movement, Tile and wobble too one show. In summer of Nothern Hemisphere its northern part lilts to wards the sun and in winter it lilts away from the sun creating warm and cold season Besides till wobble too is also shown. This is further explained in next figure. (Adopted from AB. Pittock etal climatic change and veriability 1978 p.10.)

CHAPTER 7

WARM CLIMATE: NEOLITHIC REVOLUTION, START OF AGRICLTURE IN SINDH AND RISE OF CIVILISAITON; 7,000 - 4,500 BC

Climate of Sindh has never remained the same and so has the prosperity. From 7,500 - 2,000 BC it was a warm period and there was more rain fall. The River Indus was flowing full. Summer crops like millet, sorghum and rice were yet unknown, but water from the Indus was diverted to depressions and low lying lands and was drained out in October to cultivate winter crops; wheat, oats, oil seeds, vegetables and etc., on preserved moisture. The prosperity of raising crops led to the rise of Mehrgarh (7,000 - 2,500 BC), Amri (3,700 BC), Kot Dijji (3,300 BC) and Mohenjo Daro (2,350 BC). An uninterrupted civilisation lasting for some five-thousand-and-five-hundred years and yet unparalleled existed in Sindh.

The Neolithic period of human progress registers transition from hunting-food-gathering to farming as a way of life thereby producing economic life with planned agriculture and animal husbandry. The first outcome of the transition is the settled life. From its beginnings in the Crescent countries in south-western Mediterranean, Mehrgarh in the Indus plains and number of other sites in Asia the transition spread to Europe and rest of Asia gradually in a generalized pattern. Neolithic man had to clear forests for cultivation. By experience he arrived at slush and burn method of doing so. His tool for cutting the trees was the stone exe, which in Sindh was made from flint at Rohri, Ubhan Shah (near Kot Dijji) and mile 101 on National Highway discovered by Bridget Allchin. Once agriculture was established dug out trunks of trees were used as canoes for transporting the farm produce. By about 3,000 BC wheeled vehicles were introduced, though use of the wheel for making pottery was introduced at Mehrgarh around second half of fifth millennium BC or latest by 4,000 BC. In the first half of the third millennium BC large boats of 50 to 100 or even 200 tons made from bundles of Sar grass started plying from the Indus valley to Mesopotamia carrying various kinds of articles of trade between the two countries.

Owing to well established rural economy Neolithic farmers lived together in permanent settlements, which were shifted only when along with the village agricultural land attached to it was destroyed by natural upheavals such as change in the course of river making it impossible to re-irrigate the land or when the land itself formed a low depression and became prone to frequent flooding. But as soon as the population of a settlement rose above the numbers that could not be supported from the land easily accessible the excess population had to find a new settlement.

In general wheat, barley, peas, oil seeds and cotton etc., were grown and animals like cattle, sheep, pig, goat and ass were domesticated in these settlements. Rice, which was domesticated in south India and China, subsequently moved to the Indus basin areas in the beginning of second millennium BC, as is proved by its presence at Pirak. Fishing by means of hooks, harpoons, nets and traps was later development than agriculture. A fishing tool factory has been uncovered at mile 101 on the present Karachi-Hyderabad National Highway.

The lower Indus plains were suited to Neolithic environments even more than Egypt and Iraq due to peculiar regime and behavior of the Indus flowing on the ridge inundating a belt about 15-20 miles in width along both of its banks.

People of Sindh observed and intimately understood the annual behavior of River Indus from below Panjnad to the sea. It inundated vast areas in summer depositing rich alluvium on which without much effort crops like wheat, barley, oil seeds etc., could be planted in fall and harvested the next spring. Woman had invented agriculture and had used hand hoe. Labouring the whole season she could cultivate only two acres. They also found that with a pair of bullocks yoked and used as draft animals a man could cultivate four to five times more areas than a woman

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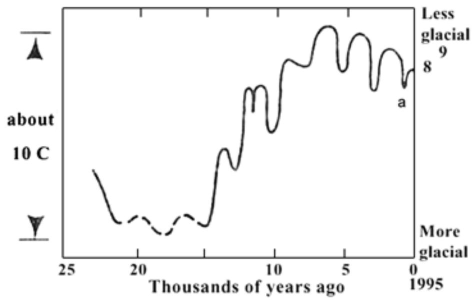

Nothern Hemisphere Temerature of the past 25,000 years, a schematic rendering on the basis of data from three kind of sources. pollen records, and tree-line and glacial records. little ice age is indicated by a Adapted from National Research Council, 1975, p. 130. by Bryson (1978)

124

I. Two Tales of Famine

A polar view showing one possible configuration of the westerlies. The band indicates their outward (southernmost) edge. The pattam is not always the same, but whatever the number of loops and their positions, one flow links the hemisphere together climatically.

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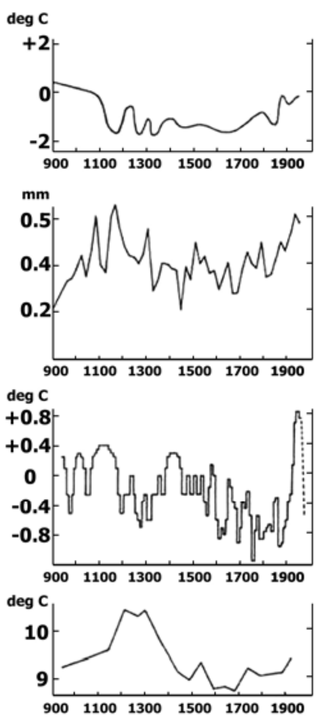
Historical and instrumental record



Climatic changes in the Northern Hemisphere over the last millennium: (a) Temperatures in China (departures from present day,C) åfter S. Wen-Hsiung (1974). (b) Prolonged rains (frequency/50 years) in Iwate, Japan after Yamomoto (1972). (c) Ringwidth of bristlecone pine, White Mountains, California after La Marche (1974). (d) Mean annual temperatures (departures from average,°C) in Iceland after Bryson (1974a). (e) Mean annual temperatures in central England from Lamb (1965 b).

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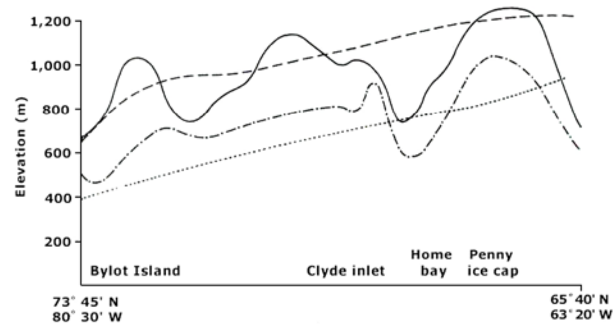
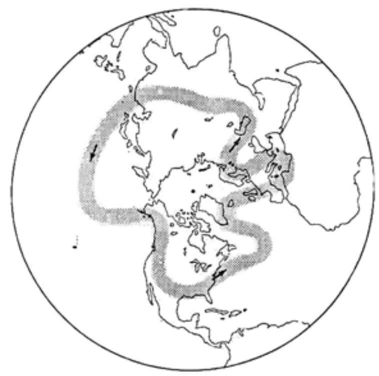
Shorter-term variations



127

The Case of the Missing Farmers



westerlies change position and endose, nearly whole USA except pacific states, Japan most of china including Tibet. Japan, while caspian sea, Turkey eastern Europ etc. westerlies have expended and have brought. cold and drought.

could with hand hoes. Since man grazed cattle he invented plough and yoke. In suitable areas he could produce more food than as food-gatherer or a woman as cultivator with a hoe. Thus the woman was relieved from agricultural production and lost freedom once for all only claiming for herself her right to equality with man 8,000 years later. Burying of woman on husband’s death or Sati is an outcome of this type of woman's slavery.

GEOGRAPHICAL SETTING SINCE MEHRGARH TIMES; HAKRA-SARSUITI AND INDUS IN SINDH

In the Mehrgarh period 7,000 - 4,500 BC Sindh had two independent river systems; the first being western tributaries of the Punjab (Jhelum, Chenab, Ravi, Beas and Sutlej) and two western tributaries (the Kabul and the Gomal rivers). Bolan, a minor tributary, which also carried its perennial water through Manchar Lake and Aral Wah to the Indus, was unimportant due to low discharges. Even the contribution of the Gomal was but trifling. The second or the eastern system was the Sarsuiti-Drishadvati-Hakra, discussed in appendix- III.

The seven river system, the center of so called Rig Vedic tribes' activity, consisted of five rivers of the Punjab, the Kabul and Indus itself. The area below the Panjnad was called and could well be so the "Sapta-Sindhu". As late as 1644 AD the Indus itself below Panjnad was called "Haft Darya" or "the seven rivers", as is stated by Mirak.

Ptolemy’s (150 AD) seven rivers are the same as Mazhar Shah Jehani’s except that Ptolemy brings in his system Swat instead of Sutlej. In early historical times the seven rivers of the Indus system were called its seven mouths. The Sapta-Sindhu area most probably consisted of parts of Bahawalpur and Sukkur divisions situated on the left bank of the River Indus. The sacred river of Rig Vedic tribes was Sindhu, which stood on equal footings with Matra, Varona and Dyauses; their gods. The Ganges became holy after 500 - 400 BC.

There is hymn in praise of the Indus in Rig Veda. They sung the glory of the Indus at that time (800 BC) when Indus below the Panjnad was the most productive area in the South Asia and possibly in the whole world then known.

The eastern river system, a historical mystery until the thirties of nineteenth century, was covered mainly by the river Sarsuiti as the lost river of the Great Indian Desert. Of many investigators of this river a few noteworthy are: Pottinger, Burnes, McMurdo, Scott, Baker, Fife, C.F. Oldham, R.D. Oldham, Haig, Raverty, Minchin Barnes, Cousens, Whitehead, Stein, Pithawalla, Lambrick, Bimal Ghose, Amal Kar & the present writer. After extensive research of a century and half it was concluded that the Hakra or the Eastern Nara was the original bed of the river Sarsuiti during Pleistocene and later on it was being supplied by rain-fed streams like Ghaghar, Jhangri, Drishadvati, Rainee and Markand. Spill water from the Sutlej also supplied water to the Hakra in every inundation season and so did the Indus between Panjnad and Bakhar.

These findings have been summarised in “Ground Water” (1964) and continued further work with the help of aerial photographs, which has shown clear connection between the Eastern Nara (Hakra) and the Sarsuiti. Geographers Holmes and Wilhelmy and archaeologist Rafique Mughal (1973) have carried out further work, discussed in Appendix-III.

It is now fairly clear that the Sarsuiti-Hakra was an independent river system during Pleistocene. Water started reducing in the second millennium BC due to titanic movements and as a consequence old Indus Civilisation settlements namely; Kalibangan, Hastinapur, Alamgirpur, Bahadurabad, Bhoot, Badrakali, Fatehgarh, Munda, Humayungarh, Dulman Bhawar, Budopal, Rangmahal, Kaiser, Suratgarh Sardargarh, Sohakot, Bijaingarh Ramsinghpur, Hakra, Sandhanwala, Marot, Kudewala, Lurowala, Borwar, Anufarh, Phulra, Mirwah, Managarh and Dingarh started decaying. These sites belong to the Bikanir and Bahawalpur area and not to the present Sindh. Sindh’s contemporary sites have not been yet examined. However, the system kept operating with ever reducing supplies. At the time of Alexander’s conquest of Sindh (325 BC) it may not have been a non-perennial system flowing mostly in summer season yet supplying enough water below Jamrao head in that season to help raise short season Kharif crops. During that season it may have been navigable too. Its supplies further reduced in time and by the beginning of thirteenth century it dried up completely.

GABARBANDS

It was probably during the Amrian storm that Gabarbands were constructed in Kohistan. They were not water storage dams, but water diversion dams. They acted as weirs and diverted part of thunder-

AGRICULTURE OPERATIONS CONTINUED IN TWENTIETH CENTURY

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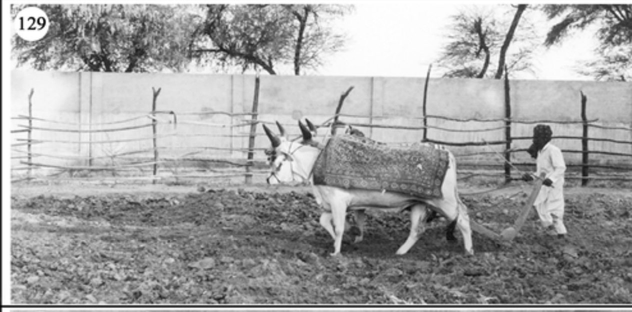
129


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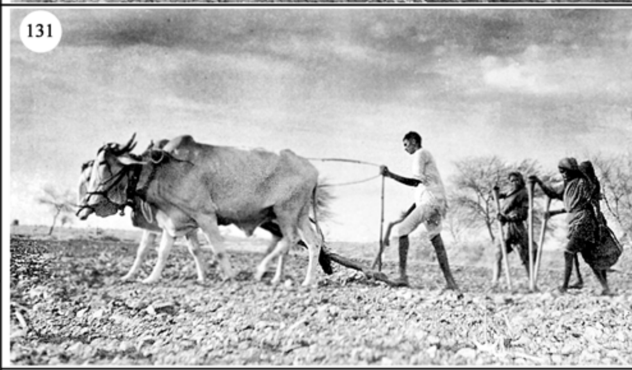

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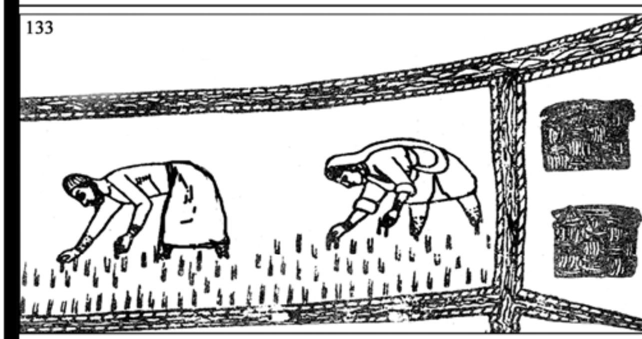

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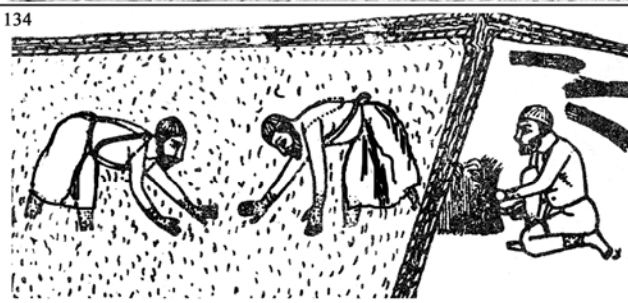

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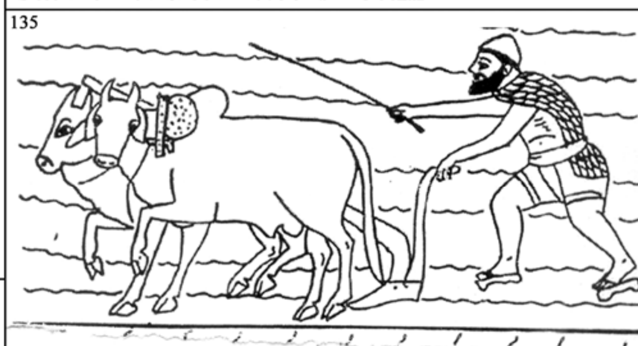

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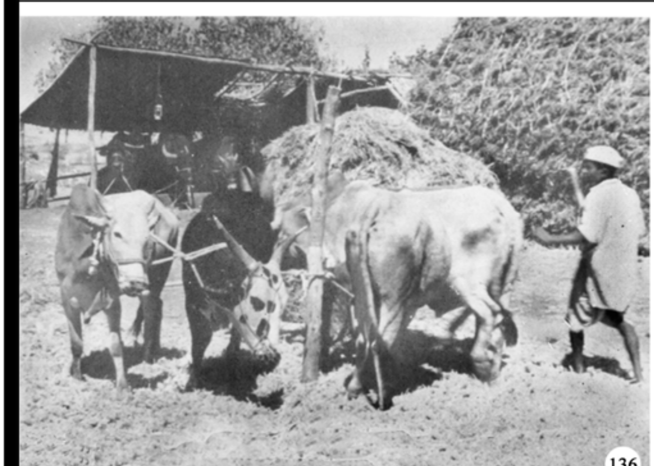

PICTURES SHOWING COMPLETE FIELD OPERATION

128. Ploughing with camel was common in 10th-18th centuries.
129. Ploughing with bullocks, common in 20th century as was 5,000 years ago.
130. Clod crushing after ploughing, a light job for women, who also carried children on their backs while working.
131. Drilling grains of some crop following ploughing, as soil is pilverised and placing grain at proper depth by tube-drill.
132. Same operation done manually some days after first irrigation.
133. Women transplanting rice seedlings.
134. Men checking transplanting by womeen and filling gaps.
135. Ploughing with oxen.
136. Threshing grain.

All these primitive operations were common during Soomra rule and even upto 1980 AD. Drawings 130,132,133 & 134 absed on MS. In the India Office Library, commissioned for William Moorecroft about 1820 AD.

water into adjoining lands, which were given proper embankments along the contour lines to hold and retain about twenty to thirty inches of water column for a few days to allow water to soak into the ground. Thus, on preserved moisture a crop of grains and oil seeds etc. was raised. The period of around 4,250 - 3,800 BC shows decline in rain fall and this may have needed construction of Gabarbands both in Sindh and Balochistan.

DIMENSIONS, FOUNDATION MATERIALS, CONSTRUCTION DETAILS AND SUGGESTED FUNCTIONS OF GABARBANDS AT PHANG NAI IN KOHISTAN

Structure	Length (m)	Height (m)	Best Width (m)	Top Width (m)	Function	Construction details (volume m^3)	Function
South	100	3	8	3	Sandstone outcrop	Dry uncut rock on sandstone outcrop (1650)	Low-head weir; primary hydraulic control
East	126	7.8	30	7	Conglomerate outcrop	Double lift, earth fill core, upstream and downstream dry uncut stone facings (43,340)	Block water gap in hogback ridge and divert flows to the south dam
North	136	4.2	8	3	Alluvium	Single lift, earth fill core, upstream and downstream dry uncut stone facings (2,650)	Block northern end of strike valley
West	75	3	10	3	Alluvium	Single lift, earth fill core, upstream and downstream dry uncut stone facing (1,350).	Trap coarse sediment during flood flow events
Spring	35	2	7	2	Conglomerate outcrop	Dry uncut rock on conglomerate outcrop (315).	Low-head weir for diversion of spring flows

The remains of such Gabarbands are found in vicinity of Kohtarash, Gozo Nai (30 miles north of Kohtarash in the upper valley of Naing Nai) and between Sita and Trapan Nai in Kamber taluka. Harvey and Flame have explored these sites on the Baran Nai already reported by Lambrick, Mujamdar and others. Dimensions of these are given in table attached and the cross section and plans show the ingenuity of the man and his understanding of hydraulic forces the structures had to withstand. Gabarbands are also discussed in chapter 9.

Table attached gives the engineering dimensions of Gabarband at Phang.

SPRINGS AS A SOURCE OF IRRIGATION

Soon after rise of Mehrgarh man in Sindh used spring water for raising crops. Present writer has located forty three springs in Kohistan of which at least half supported irrigated agriculture until at least 3,000 BC specially when rain fall between about 9,000 - 4000 BC was two-and-half times what it is today. Some springs like Naing, Wahi Pandhi, Damb Buthi, Taung and Kai support irrigated agriculture even today. Beginning of irrigated agriculture goes to springs first followed by Gabarbands. Irrigation from springs, which flowed year around in a small stream, was easily utilised for raising crop and is a definite proof of its introduction before Amrian times. Irrigation from the Indus itself is a development dating back to Amrian times (3,500 BC) in the form of filling depressions and draining them for cultivation and use of Wahurs, Dhoros and Dhoris; a rudimentary type of irrigation.

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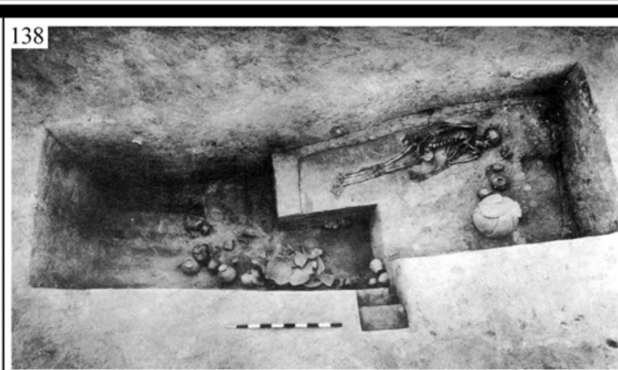

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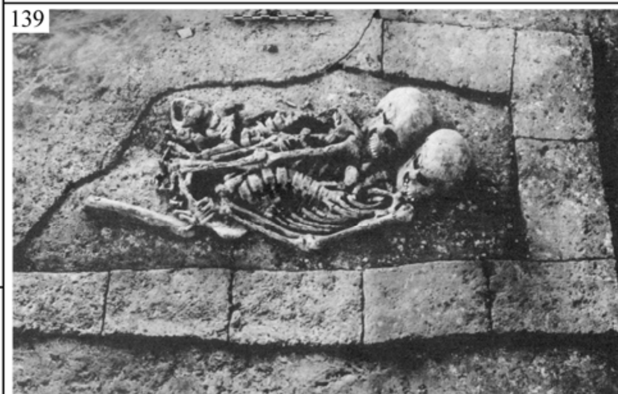

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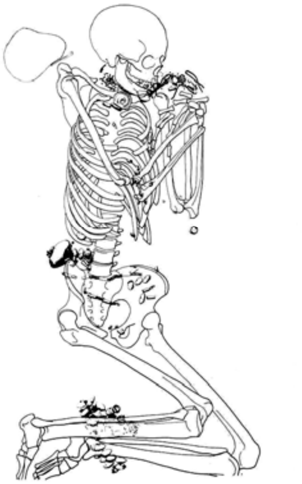

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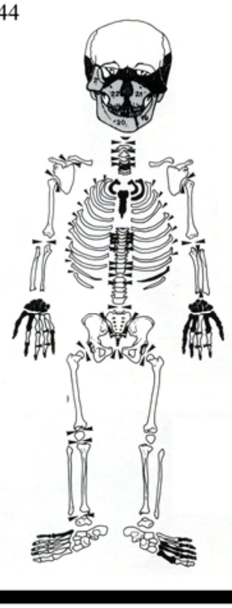

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BURIALS AT MEHRGARH

137. Location map of Mehrgarh
138. An extended burial. Lower level, a pot burial without skeleton. Harappan Period. Kalibangan.
139. A double burial inside a brick-lined grave, Lothal.
140. Mehrgarh Burial, 6500-6000 BC
141. Sketch of burial 121 to show deposition of grave goods, area MR 3, period IB, Mehrgarh
142. Mehrgarh burial, 6000-5500 BC
143 & 145. Mehrgarh burial, 7000-6500 BC
144. Mehrgarh, reconstruction of skeleton. Area MR 3, period IB

CONSEQUENCES OF AGRICULTURE

The consequences of food production were revolution in itself and are discussed in paragraph below:

Production of more food than the family needed resulted in the overall surplus, which was utilised in feeding and raising artisans, traders, bureaucrats and priests and above all the despots who controlled and rationed the means of agricultural production i.e. the land and water.

This in turn led to the rise of state for recovery of part of farm produce and also need for keeping records for which arts of writing and mathematics were invented.

It resulted in freeing some people from agriculture who built big settlements towards cities further causing growth of urban life leading to development of culture including trade, arts and crafts, luxury goods, means of storage and of transport and communications etc.

This was to be followed by further inventions and discoveries connected with further development and improvement of irrigation system; its security and maintenance, control and distribution of water supply to individual farms as well as individual farmers for obtaining higher production of food grains to meet requirements of agriculturists as well as those of non-agricultural rural or urban population.

Imposition of slavery involving vast masses of people was bound to agriculture so that the needed high production could be ensured. This mass slavery of the land tillers continued in all the ancient irrigated parts of the world including the Indus valley for the next 5,500 years i.e. to this day and not as bought out slaves, but creating caste system by various methods to keep them socially inferior, economically poor and attached to the land. Absconding of tillers from land was discouraged except when they were surplus. Absconding tillers are returned to the original land owners even now by an unwritten law observed by all other land owners by use of force.

The fact that almost all the known pre-historic mature Indus culture sites in Sindh are located in the proximity of modern villages of irrigated area indicates ancient's similar dependence upon identical water and soil resources as of today's rural population. The principal forest trees Babul (acacia arabica), tamarisk (gallica dioica) and Kandi (prosopis spicigeva) are main sources of local fuel today as they had been for centuries.

EVOLUTION OF CROPS IN SINDH

The domestication of crops and animals started in Mehrgarh in the following sequence:

7,000 or 6,000 BC; The cereals cultivated and animals domesticated were: Naked (sphaerococcoid) barley, 6 row barley (hordeum vulgare), wild barley (hordeum vulgare varinudum), Einkorn and Emmer (tritium dictum wheat). Domestication of cow and buffalo followed with a gap of some centuries by domestication of sheep and goat.

6,000 - 5,000 BC; Introduction of durum bread wheat, peas (pisum orvonse), about 3,000 to 3,500 years before their presence/introduction at Mohenjo Daro, dates (phoenix dolylifera), more than 3,000 to 3,500 years before Mohenjo Daro and oil seeds (sesame and mustard), about 3,000 to 3,500 years before Mohenjo Daro - around 6,000 to 5,500 BC.

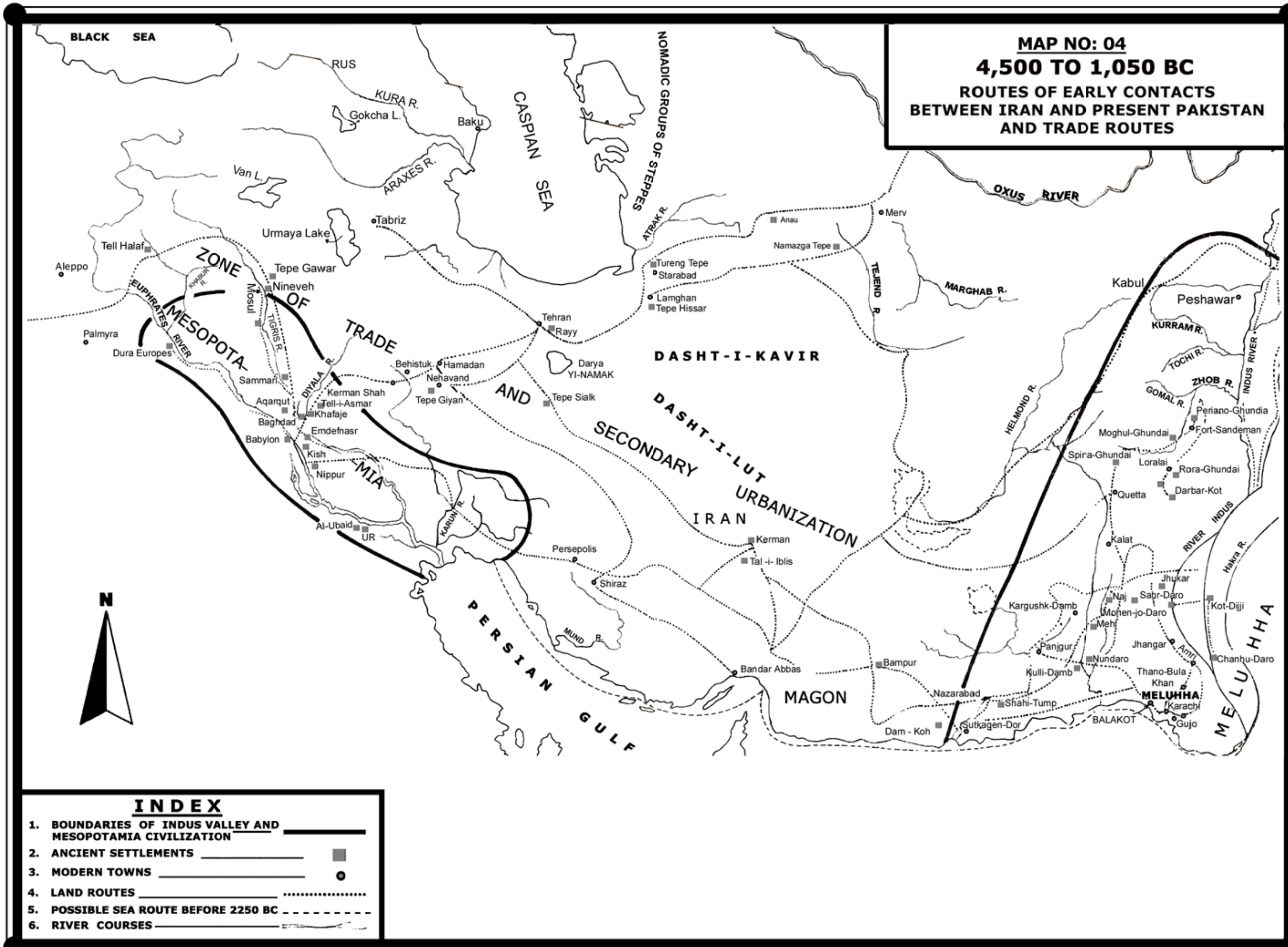
4,500 - 4,000 BC; Cultivation of cotton for fibre and probably oil. New variety of wheat (tritium aestivum) introduced. Naked wheat (sphaerococcoid) introduced soon after 4,000 BC.

INHERITANCE OF LIFE PATTERN OF NEOLITHIC FARMERS FROM HUNTER-FOOD-GATHERERS (14,000 - 9,000 BC)

Table below shows the life pattern of hunter-food-gatherers:

Houses	**Tents from skins of animals**
Bed mattresses	Skin filled with straw and feathers
Life expectancy	28-32 years
Women produced 3-4 children at age of	18, 22, 26 and 30
Number of animals slaughtered per year per adult	12-13
Hunting band size	30-40 people

Neolithic changed the above patterns in the following ways: mud houses with thatched material and wooden roof and use of fibre for clothes and mattresses. Life expectancy increased. Due to intake of more carbohydrates woman gained weight and more than 10 child births during her life became possible. Five acres of land could support a family of eight. Sizes of villages increased to a few hundreds in beginning and to a thousand or more later on.



MAP NO: 04
4,500 TO 1,050 BC
ROUTES OF EARLY CONTACTS
BETWEEN IRAN AND PRESENT PAKISTAN
AND TRADE ROUTES
BLACK SEA
RUS
KURA R.
Gokcha L.
Baku
CASPIAN SEA
NOMADIC GROUPS OF STEPPES
Van L.
ARAXES R.
Tabriz
Urmaya Lake
Tell Halaf
Aleppo
Tepe Gawar
Nineveh
Mosul
ZONE OF TRADE AND SECONDARY URBANIZATION
EUPHRATES RIVER
KHABUR R.
MESOPOTA-MIA
TIGRIS R.
Palmyra
Dura Europes
Sammari
DIYALA R.
Kerman Shah
Tell-i-Asmar
Khafaje
Aqarqut
Baghdad
Emdefnasr
Babylon
Kish
Nippur
Al-Ubaid
UR
KARUN R.
Behistuk
Hamadan
Nehavand
Tepe Giyan
Tehran
Rayy
Darya YI-NAMAK
Tepe Sialk
ATRAK R.
Tureng Tepe
Starabad
Lamghan
Tepe Hissar
Anau
Namazga Tepe
Merv
TEJEND R.
MARGHAB R.
OXUS RIVER
DASHT-I-KAVIR
DASHT-I-LUT
IRAN
Kerman
Tal -i- Iblis
Persepolis
Shiraz
MUND R.
PERSIAN GULF
Bandar Abbas
MAGON
Bampur
Nazarabad
Dam - Koh
Sutkagen-Dor
Shahi-Tump
HELMOND R.
Kabul
Peshawar
KURRAM R.
TOCHI R.
ZOHB R.
GOMAL R.
INDUS RIVER
Periano-Ghundia
Fort-Sandeman
Moghul-Ghundai
Spina-Ghundai
Loralai
Rora-Ghundai
Darbar-Kot
Quetta
Kalat
RIVER INDUS
Hakra R.
Jhukar
Naj
Sabr-Daro
Kot-Dijji
Kargushk-Damb
Mohen-jo-Daro
Mehi
Jhangar
Amri
Panjgur
Nundaro
Chanhu-Daro
Kulli-Damb
Thano-Bula Khan
MELUHHA
Karachi
BALAKOT
Gujo
MELUHHA
N
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2. ANCIENT SETTLEMENTS
3. MODERN TOWNS
4. LAND ROUTES
5. POSSIBLE SEA ROUTE BEFORE 2250 BC
6. RIVER COURSES

COOKING VESSELS

Life was not easy for the Neolithic or even hunter-food-gatherers. Cooking methods and vessels used from 10,000 years ago to 6,000 years ago listed below show the type of drudgery for women whose duties included cooking for the whole family.

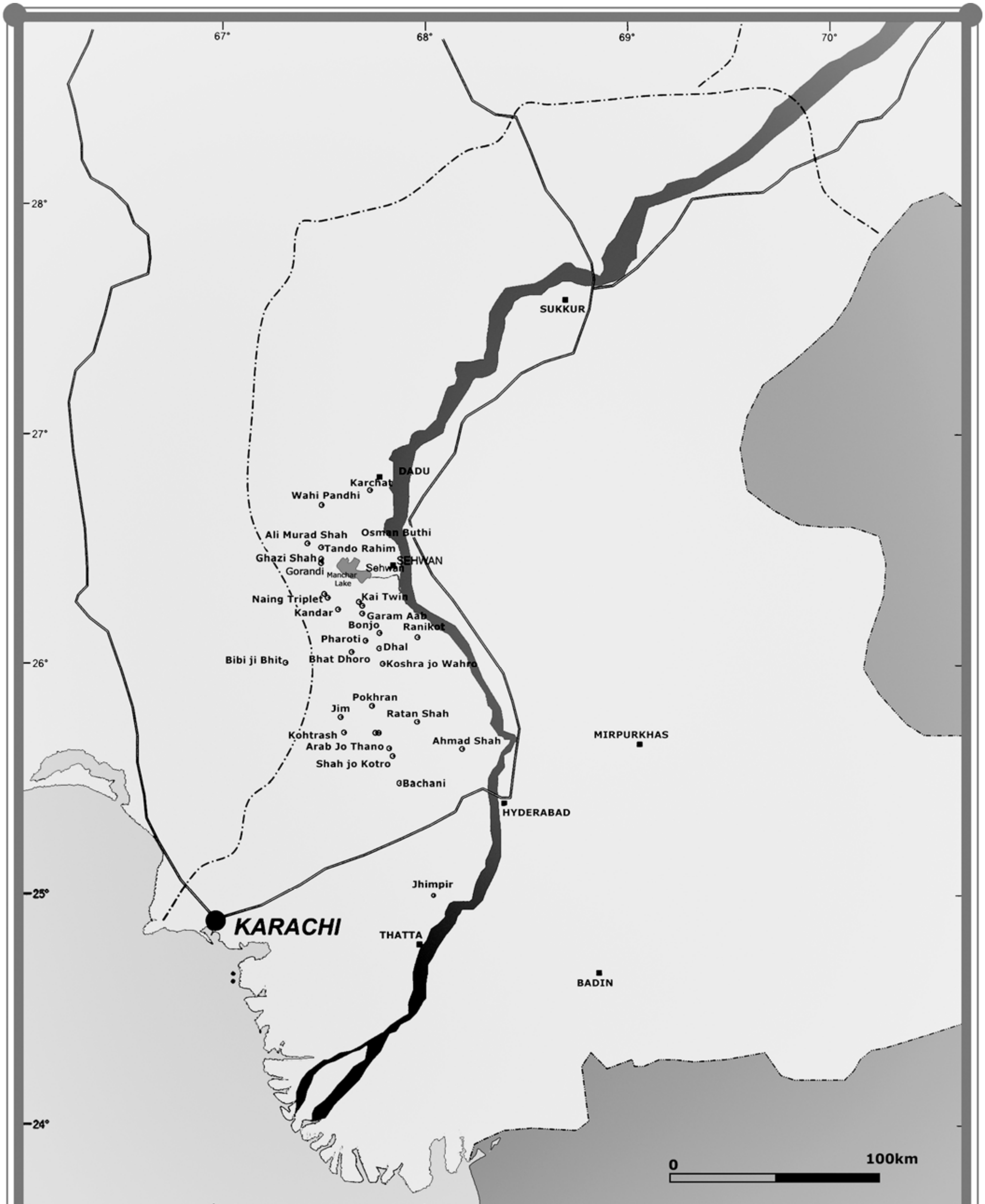
Years ago	Vessels for cooking
10,000-9,000 years	Open hearth and roasting
8,000 years	Cylindrical burnt clay pots were used. Heating was done by immersing hot pebbles and burnt clay pieces into food being cooked.
7,000 to 6,000 years	Semi-spherical bottom clay pottery on clay tripods introduced

Earliest known pottery came from Catal Huyuk around 10,600 years ago - a gap of 2,500 years with Mehrgarh.

Potters wheel made semi-spherical bottom pottery possible and its production on mass scale and very cheap. Potters wheel was known in Ur (Iraq) in 3,250 BC and it may have been invented at Siyalk-III earlier. It was used at Mehrgarh around 4,000 BC, but in Sindh sites first evidence comes in Amrian times around 3,500 BC. At Kili Gul Muhammad, near Quetta it is dated as 3,600 - 3,300 BC.

TABLE SHOWING SPRINGS IN SOUTH-WEST SINDH

S. No.	Name of spring	Coordinates	Water discharge (litres/sec)	Quality salts (ppm)	Area irrigated (acres)
1.	Ghazi Shah, Johi taluka (Thermal)	26°-27’ N, 67°-30’ E	85	770	450 Fresh
2.	Phadak, Johi taluka		70	Fresh	350
3.	Wahi Pandhi, Johi taluka	26°-41’ N, 67°-30’ E	-	Fresh	250
4. to 7.	Four Gaj springs, Johi taluka	Upstream of Gaj	-	Fresh	-
8.	Tando Rahim (Thermal)	26°-30’ N, 67°-30’ E	-	-	-
9.	Pharoti, Sehwan taluka	26°-6’ N, 67°-43’ E	30	450 Fresh	-
10. & 11.	Kai (twin springs), Sehwan taluka	26°-15’ N, 67°-42’ E & 26°-16’ N, 67°-41’ E	85		
12. to 14.	Naing (triplet spring), Sehwan taluka (Thermal)	26°-17’ N, 67°-32’ E and 26°-18’ N, 67°-31’ E	85	Fresh	500
15.	Bonjo, Sehwan taluka (Thermal)	26°-8’ N, 67°-47’ E	70	800 Fresh	350
16.	Dhal, Sehwan taluka	26°-04’ N, 67°-47’ E	5	Slightly saline 1050	20
17.	Bhat Dhoro or Lahri Dhoro, Sehwan taluka	26°- 3’ N, 67°-39’ E	5	Fresh 500	
18.	Gorandi, Sehwan taluka (Thermal)	26°-26’ N, 67°-30’ E	8	Fresh	50
19. to 21.	Laki (triple springs), Kotri taluka (Thermal)		18	Brackish	-
22.	Rani Kot, Kotri taluka (Thermal)	26°-07’ N, 67°-58’ E	15	Slightly saline 800	50



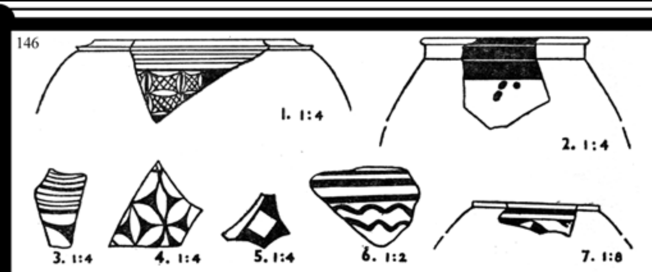
MAP NO: 05

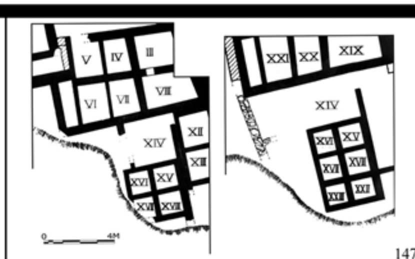
LOCATION OF SPRINGS OF SINDH

NOTE:

THE AREA SHOWN IN THE MAP HAS 42 SPRINGS. SOME OF THE SPRINGS YIELD HOT WATER. SINDH HAS 80% THERMAL SPRINGS OF SOUTH ASIA. A FEW THERMAL SPRINGS ARE ALSO USED FOR IRRIGATION.

23. & 24.	Khajur, Mahal Kohistan taluka (double springs)	25°-42’ N, 67°-47’ E	-	Fresh	-
25.	Dhorogar, Kotri taluka	35 0/11	8	Fresh 650	-
26.	Karogar, Kotri taluka	35 0/11	15	Fresh	-
27.	Ali Murad, Mahal Kohistan taluka	26°-31’ N, 67°-26’ E	3	Fresh	10
28.	Karchat, Mahal Kohistan taluka	25°-45’ N, 67°-44’ E	15	600 Fresh	500
29.	Pokhan, Kotri taluka	25°-49’ N, 67°-45’ E	15	900	
30.	Ratan Shah or Taung	25°-45’ N, 67°-35’ E	15	Slightly saline 1050	80
31.	Jim, Kotri taluka (Thermal)	25°-46’ N, 67°-36’ E	15	750, Fresh	-
32.	Khair, Kotri taluka		5	-	-
33.	Jasia, Kotri taluka				
34.	Kohtarash or Ghaibi Pir, Kotri taluka	25°-42’ N, 67°-37’ E		Slightly saline, 1120	500
35. & 36.	Hikebroo and Gabar, (twin springs) Kotri taluka	35 0/10 Grid C 664 903	3	Saline 2000-2300	-
37.	Koshra-jo Wahro, Kotri taluka (Thermal)	26°-0’ N, 67°-48’ E		800, Fresh	
38.	Garam Aab, Kotri taluka (Thermal)	26°-13’ N, 67°-42’ E	-	800	
39.	Kandar, Kotri taluka (Thermal)	26°-14’ N, 67°-35’ E	-	Slightly saline	-
40.	Bibiji Bhit, Kotri taluka	26°-0’ N, 67°-20’ E	-	Slightly saline	-
41.	Arab jo Thano	25°-38’ N, 67°-50’ E	-	Fresh	-
42.	Shah jo Kotrio	25°-36’ N, 67°-51’ E	-	Fresh	-
43.	Ahmed Shah	25°-38’ N, 67°-71’ E	-	Fresh	-
44.	Osman Buthi	25°-32’ N, 67°-49’ E	-	Fresh	-
45.	Bachani, Kotri taluka	25°-29’ N, 61°-53’ E	-	Fresh	-
46.	Jein Pir, Thatta taluka (Thermal)	25°-00’ N, 68°-03’ E	-	Slightly saline	-
47.	Mangho Pir, Karachi West (Thermal)	24°-39’ N, 67°-06’ E	-	-	-
48.	Mangho Pir Shrine, Karachi West	24°-37’ N, 67°-06’ E	-	-	-
49.	Khadeji Falls, Karachi North	-	-	-	-





146. Pottery of Jhukkar.

147. House plan, Amri.

SNAKE WORSHIP

Snake worship or snake as deity can be traced back to 3000 BC in Sindh as discused on previous page. It was common in Crete and other Mediterranean countries

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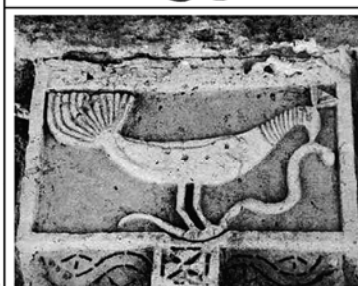

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148. Naga, 125 X 85 cms. Alampur Archaeological Museum, Andhra Pradesh.
149. Naga Raja carved on schist stone decorated with lily flower from Brahmanabad-Mansura.
150. Manasa goddess of snakes. Bronze, 46 X 18 cms, British Museum.
151. Mycenaean's snake goddess from Crete, 1600 BC, from palace of Knossos. She may have been queen, princess or priestess. Faience, H. 29.5 cms. Heraklion Museum Crete. (Art of Classical World, by Donald Strong, London 1965 AD).
152. Krishna subduing the serpent demon, Kaliya, 600 BC
153. Cooling oneself
154. Bird holding snake at the tomb of Badi-uz-Zaman Tarkhan at Makli, Thatta, 1580 AD
155. Highly decorated female deity with snakes around hair, neck, arms, etc. (MHP).
156. Highly decorated male deity with snakes around hair, neck, arms, etc. Probably Siva (MHP).
157. Indian snake charmer kissing cobra. Dawn Karachi dated 9th August 2002 calls it "Kiss of Death". Cobra gets paralysed by summer heat and can not open its mouth. Only in cool of night he is able to feed. It is therefore safe to play with it.

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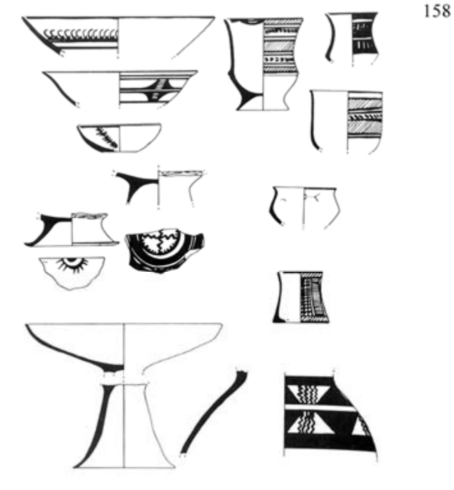

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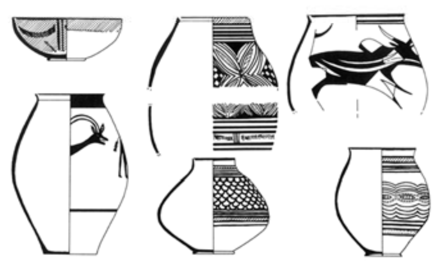

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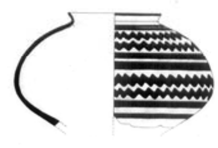

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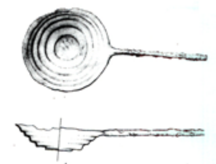

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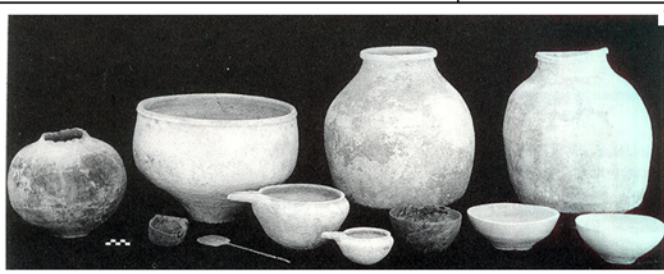

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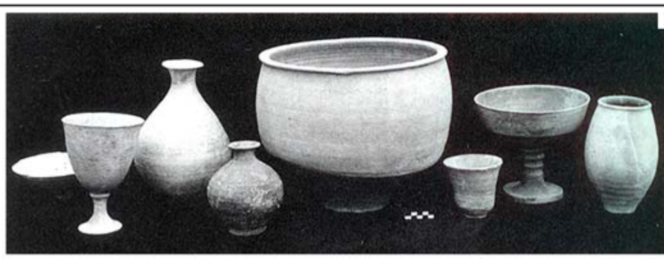

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CERAMICS AND POTTERY

158. Pottery from Amri Period IB.
159. Ceramics (vase) with painted pattern from Mehrgarh, area MR 1, period IV
160. Ceramics (vase) with painted pattern from Mehrgarh, area MR 1, period IV
161. Pottery 6000-5500 BC
162. Pottery from Amri Period ID.
163. Ceramics (pot) with painted pattern from Mehrgarh, first period (period IV)
164. Ceramics (pot) with painted pattern from Mehrgarh, fourth period (period VII)
165. Ceramics (pot) with painted pattern from Mehrgarh, fourth period (period VII)
166. Pot with painted pattern from Mehrgarh, first period (period IV)
167. Ceramics (pot) with painted pattern from Mehrgarh, third period (period VI)
168. Ladle from Mehrgarh, area MR 1, period VIII
169. goods; pottery and copper. Area MR SB, period VIII
170. Pot 6000-5500 BC
171. Ceramics with painted pattern from Mehrgarh, area MR 1, period VIIB
172. (cenotaph) with painted pattern from Mehrgarh, area MR 1, period VIII
173. Mehrgarh, funerary deposits from cenotaph 6, sector MR U3 7A. Area MR 1, period VIII

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GEOMETRICAL PATTERNS AND OTHER MOTIFS IN POTTERY

174. Bowl with painted pattern from Mehrgarh, period IV
175. Ceramics with painted pattern from Mehrgarh, first period (period IV)
176. Ceramics with painted pattern from Mehrgarh, third period (period VI)
177. Ceramics with painted pattern from Mehrgarh, fourth period (period VII)
178. Ceramics with painted pattern from Mehrgarh, fourth period (period VII)
179. Ceramics with painted pattern from Mehrgarh, fourth period (period VII)
180. Ceramics with painted pattern from Mehrgarh, fourth period (period VII)
181. Ceramics with painted pattern from Mehrgarh, fourth period (period VII)
182. Ceramics (Kechi Beg Bowl) with painted pattern from Mehrgarh, first period (period IV)
183. Ceramics with painted pattern from Mehrgarh, third period (period VI)
184. Ceramics with painted pattern from Mehrgarh, third period (period VI)
185. Ceramics with painted pattern from Mehrgarh, third period (period VI)
186. Ceramics (plate) with painted pattern from Mehrgarh, third period (period VII)
187. Ceramics (plate) with painted pattern from Mehrgarh, third period (period VI)
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189. Ceramics with painted pattern from Mehrgarh, third period (period VI)
190. Ceramics (bowl) with painted pattern from Mehrgarh, third period (period VI)
191. Ceramics (bowl) with painted pattern from Mehrgarh, third period (period VI)
192. Ceramics (plate) with painted pattern from Mehrgarh, third period (period VI)
193. Ceramics with painted pattern from Mehrgarh, third period (period VI)
194. Ceramics with painted pattern from Mehrgarh, area MR 1, period VIIA
195. Ceramics with painted pattern from Mehrgarh, area MR 1, period VIIB
196. Ceramics with painted pattern from Mehrgarh, fourth period (period VII)
197. Ceramics with painted pattern from Mehrgarh, fourth period (period VII)
198. Ceramics with painted pattern from Mehrgarh, area MR 1, period VIIA
199. Ceramics with painted pattern from Mehrgarh, area MR 1, period VIII
200. Ceramics (pot) with painted pattern from Mehrgarh, area MR 1, period V/VI
201. Ceramics with painted pattern from Mehrgarh, area MR 1, period VIIC
202. Ceramics with painted pattern from Mehrgarh, area MR 1, period VIIB
203. Ceramics with painted pattern from Mehrgarh, area MR 1, period VIII
204. Painted jar, period VI, Mehrgarh
205. Other object (flash with handle) from Mehrgarh, area MR 1, period VIII
206. Ceramics (dish) with painted pattern from Mehrgarh, area MR 1, period VIIB

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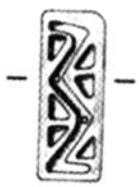
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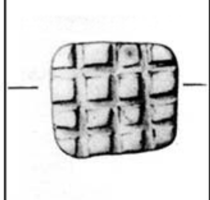
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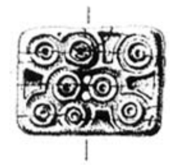
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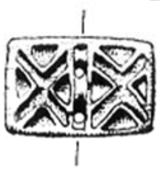
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MEHRGARH SEALS

207. Round seal in terracotta, third-fourth period (period VI-VII)
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210. Square seal in terracotta, fourth period (period VII)
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225. Seal in terracotta, fourth period (period VII)
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227. Seal in terracotta, MR 1 (period VII)
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229. Terracotta button seal (left) and imprint (right) from loc. area MR 1, period VII
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232. Incised unbaked clay ball from Mehrgarh, area MR 2, period III
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237. Cylinder seal in grey/white stone from loc. IV, area MR SB, period VIII
238. Cylinder seal in grey/white stone from loc. IV, area MR SB, period VIII

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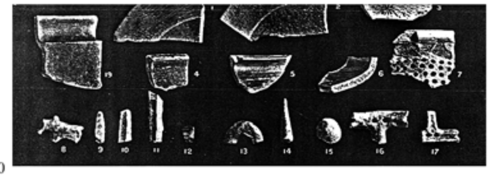

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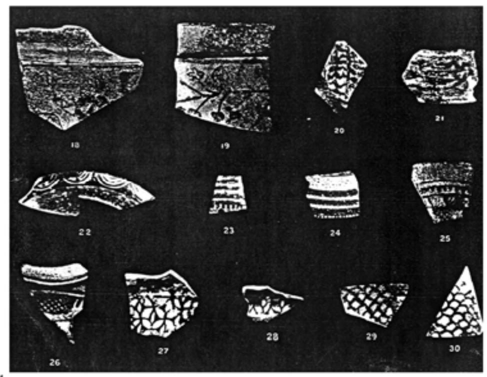

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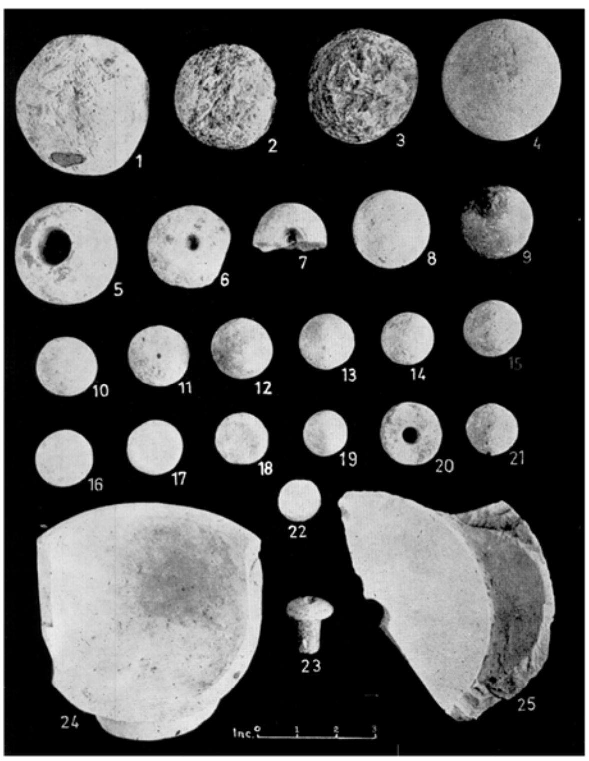

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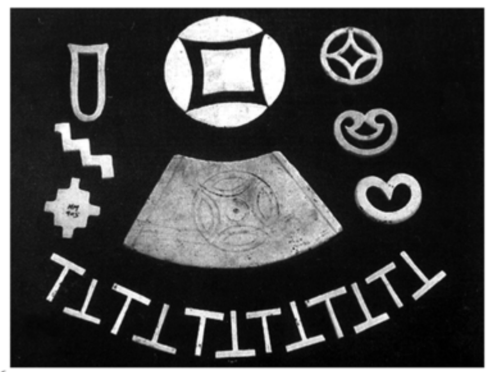

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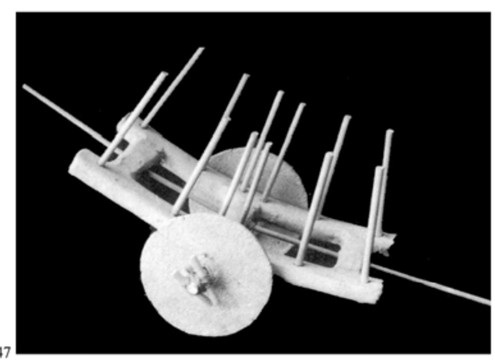

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KOT DIJJI AND INDUS CULTURE, POTTERY AND OTHER OBJECTS

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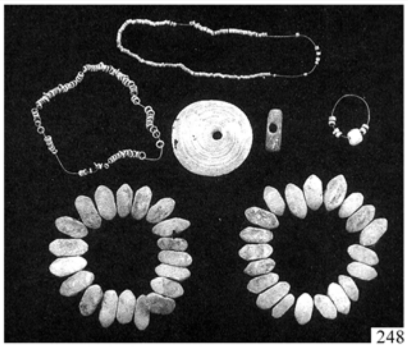
246. Assorted shell inlaid objects with intersecting-circle and (womb) motif from Mohenjo-daro, 2500 BC
247. Terracotta model oxcart from Nausharo, 2500 BC



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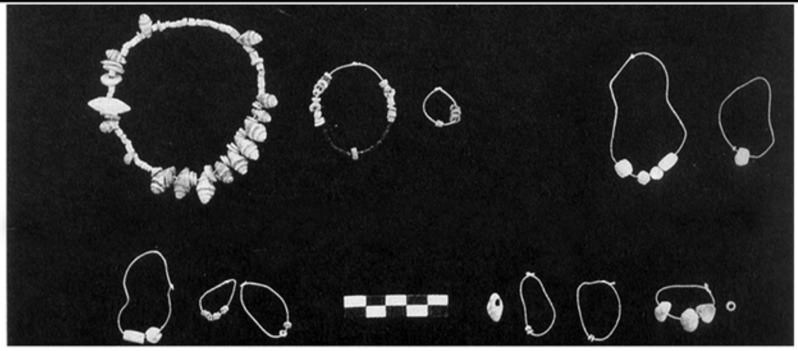

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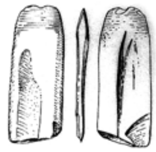

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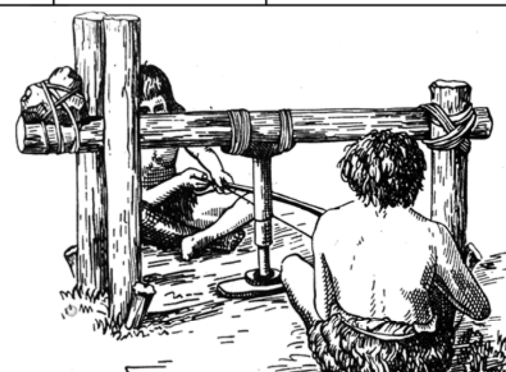

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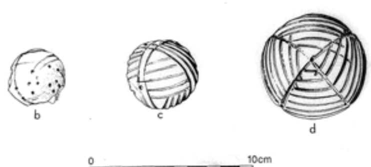

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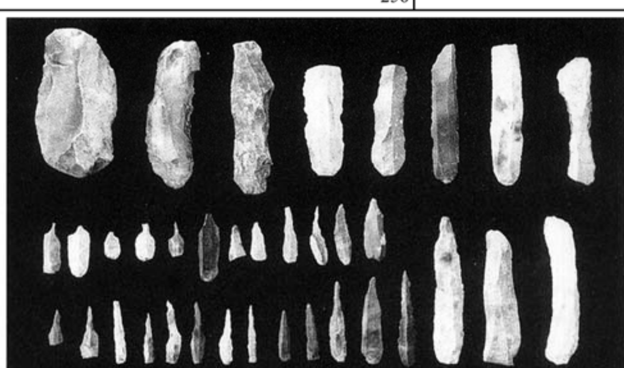

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ORMAMENTS, TOOLS AND OTHER OBJECTS

248. Ornaments from burial 287, period IA, Mehrgarh.
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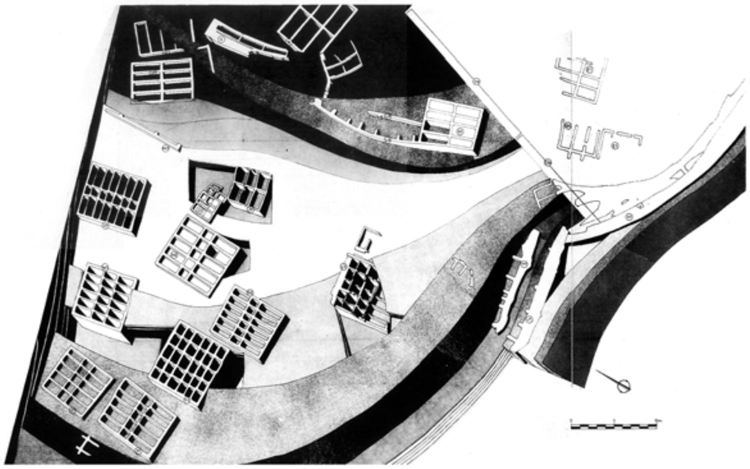
250. Amulet in white steatite from zone SB 2K, period VIII, Mehrgarh.
251. Mehrgarh, stone chisel. Area 3/4, period IA-IIA
252. Mehrgarh, terracotta bell. Area MR 1, period V/VI
253. Sickle made of chert blades set in bitumen (natural). The original wooden handle is not preserved, Mehrgarh, 3300 BC
254. Borers from Mehrgarh, area MR 3, period IB
255. 10,000 to present times: Primitive drill machine to bore hole into stone. Such drills modified for one man operations are still in use for wood working.
256. Incised clay ball (c&d) terracotta rattles. Area MR 2, period IIIB, Mehrgarh
257. Bone awls from Mehrgarh, area MR 3, period IB
258. Mehrgarh, chipped stone assemblage. Area 3/2, period IIA
259. Bone pendant from building J2, period IIA, Mehrgarh.
260. Terracotta rattle impressed and pierced to holes from Mehrgarh, area MR SB, period VIII



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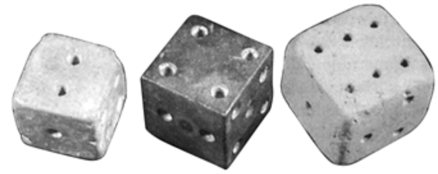

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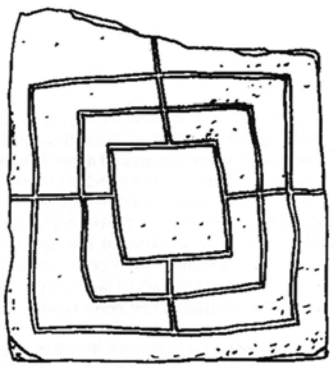

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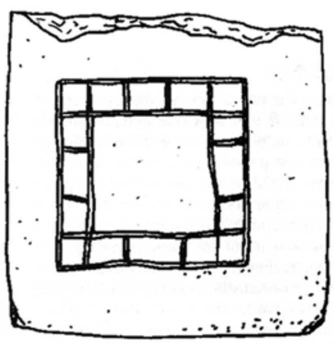

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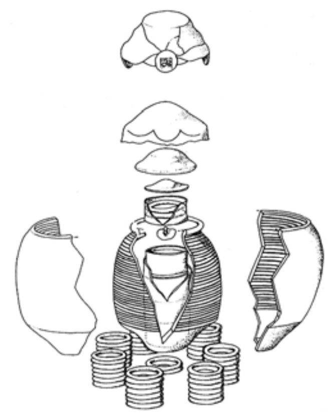

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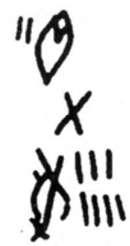

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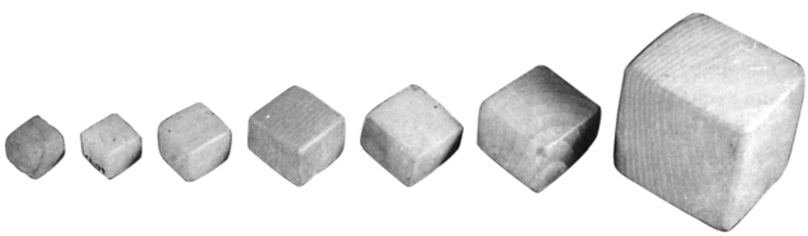

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HOUSE PLANNING, WEIGHTS AND ENTERTAINMENT

261. Isometric plan of buildings in periods IB and IIA, area MR 3/2, Mehrgarh
262. Cubical dice made of clay and stone, Harappa, 2500 BC
263. Geometric button seals from Mehrgarh, 3000 BC
264 & 265. Gaming board designs from Lothal and Harappa, 2500 BC (fig.264. Naotinn. This game is known from a terracotta piece at Mohenjo Daro and is played even now in Sindh as it was 4, 350 years ago. It is also played in Czechoslovia villages as present writer witnessed. It may have its origins more than 12,000 years ago, when hunter-food-gatherers from present Pakistan and Eastern Europe moved in the central Asian savannas for killing wild animals.
266. Diagram of canisters and containers for stoneware bangle firing, after Halim and Vidale, 2500 BC
267. Dice and a rolling game, 2500 BC.
268. Drawing of inscription that encircles the gold ornament
269. Cubical chert weights from Allahdino, 2500 BC

CHAPTER 8

AMRI - THE EARLIEST SITE OF IRRIGATED AGRICULTRE; STARTING IN 3,700 BC

Amri, one of the important sites in the early Indus culture, dating back to around 3,750 BC owes its existence and importance to its location being at the terminus of Indus flood plain and Manchar Lake drainage system. Manchar was supplied water from five sources:

a) Khuzdar-Kolachi-Gaj river drainage system.
b) Drainage of the western branch of the River Indus i.e. Nara and its predecessors.
c) Drainage from the Bolan River through Kachhi plains and Sindh Hollow.
d) The Indus via Aral during inundation season.
e) Naing and other hill streams draining to Manchar Lake from south and west.

A large number of the Indus culture sites starting with Mehrgarh exist on these three drainage systems some of which precede Amri and others follow. Judeirjo Daro being one such important site in the north and many others namely; Wahi Pandhi, Ali Murad, Tando Rahim Khan, Ghazi Shah, Shah Hasan, Lakhiyar, Gorandi and Naing.

NEW CROPS INTRODUCED AT AMRI 4,000 - 2,350 BC

1. Club wheat (tritium compactum) introduced at Mundigak.
2. Naked (sphaerococcoid) wheat introduced at Mehrgarh.
3. Zizyphus vularis (Ber) at Mundigak.
4. Parallel sites were; Mundigak-I, Kili Gul Muhammad, Loralai, Zhob and Anjira in Balochistan and Amri in Sindh.

2,300 - 1,650 BC; RISE AND FALL OF MOHENJO DARO

Parallels: Mundigak-III and IV, Damb Sadat-I and Anjira-II and III in Balochistan, Wahi Pandhi, Ghazi Shah and Paijo Kotrio (in Dadu district) and Kot Dijji in Sindh. (There are some authorities of the opinion that sorghum and millet as summer crops were introduced from Africa to south India and there from they travelled to Indus sites in Balochistan around 1900 BC. But how it travelled direct to south India is not explained as there were no boats plying from Africa to the south India. The knowledge of "Trade Winds" was a development of 2,500 years later. Boats were not large enough to sail direct to India even if knowledge of sail was known. A ship wreck on African coast could not bring survivals and grain to India as the last possibility.

AGRICULTURE IN INDUS FLOOD PLAINS

It has been stressed that the Indus flood plains were a vast swampy land unfit for permanents, therefore first settlers occupied foot-hills from Dhadhar-Sibi to Manchar and further down to hilly plateau of southern Dadu, northern Thatta and Karachi districts. Later on as population increased man was forced to settle in jungle like Indus valley plains and began the arduous process of clearing it.

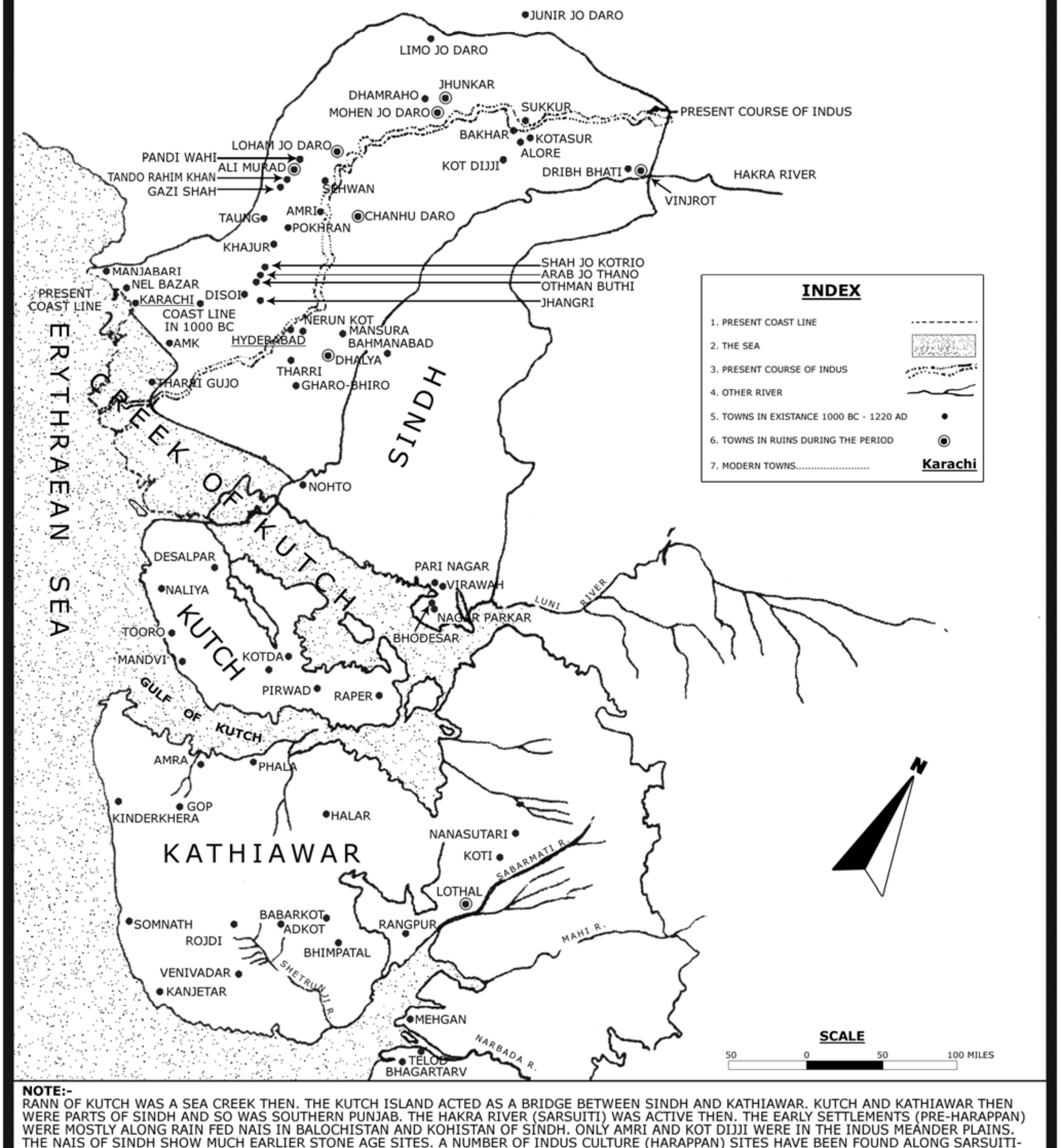
About half a century’s involvement in agriculture, irrigation, drainage and ground water in Sindh has led this author to one conclusion that the contours of the area have all along remained such that swamps were always a feature of landscape and not only that but with only small efforts they could be drained off if need be. Most of the plains consisted of seasonally flooded natural basins, which supported various grasses (including wheat and barely), brush and vegetation and formed savannahs while the higher levels along the river were covered with trees like acacia, tamarisk, prosopis, poplar, zizyphus mamorlia and perhaps mauritania etc. There were also high spots permanently safe from floods on which year around habitation was possible. It was also believed that deltaic area was unsuitable for human settlement.

MAP NO: 06

2600 BC - 1226 AD

THE CREEK OF KUTCH MAKING KUTCH AS BRIDGE BETWEEN SINDH , KATHIAWAR AND WESTERN GUJARAT

KUTCH AS AN ISLAND WAS EASILY APPROACHABLE THAN ANY TWO TOWNS OF SINDH 50 MILES APART AND SO WAS THE CASE WITH KATHIAWAR AND THE WESTERN GUJARAT. DRYING UP OF HAKRA AND SEISMIC ACTIVITY CAUSING RISE OF THE BED OF RANN OF KUTCH STOPPED EFFECTIVE COMMUNICATION WITH KUTCH AND KATHIAWAR IN THE 13TH CENTURY.



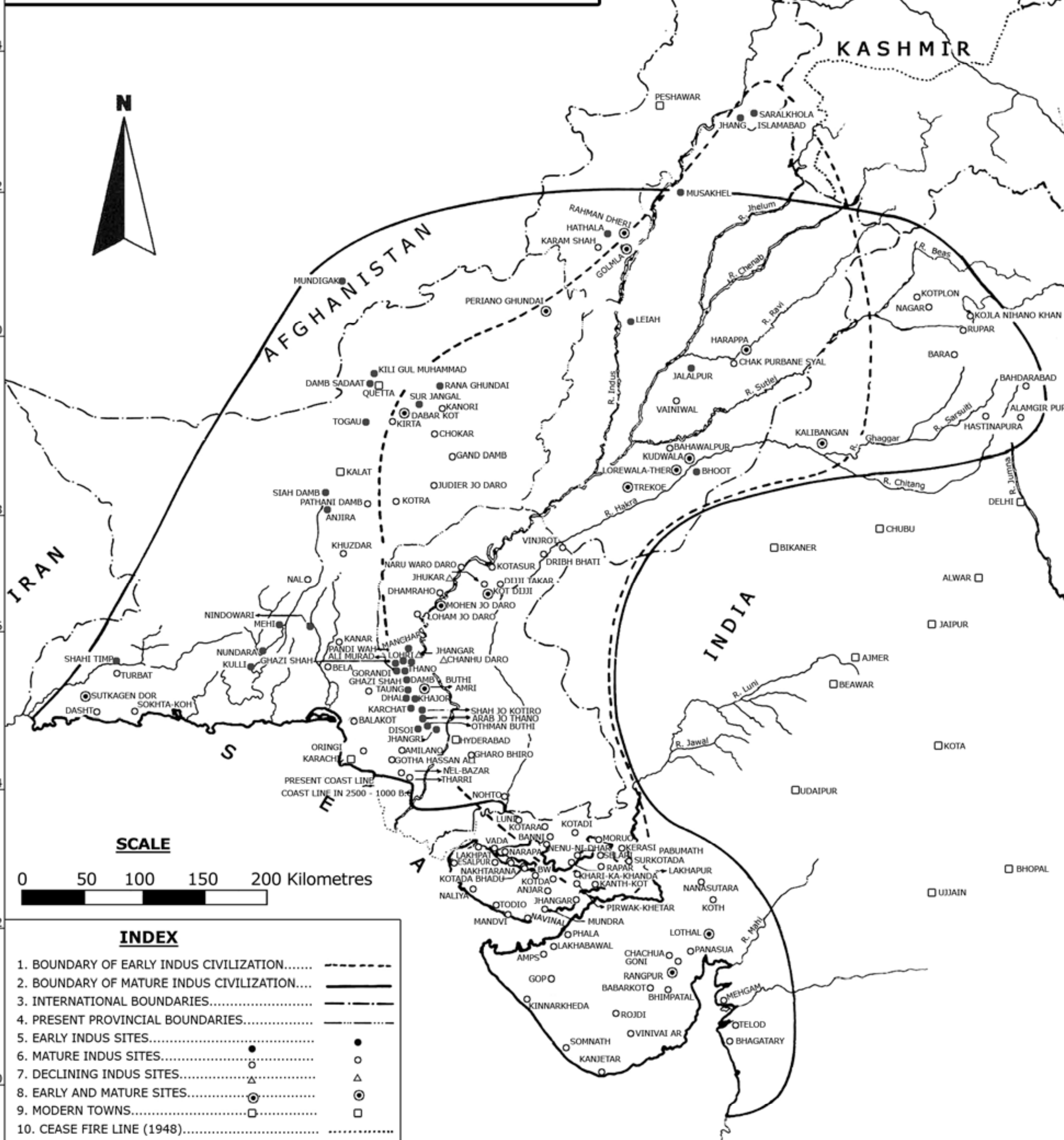
NOTE:-

RANN OF KUTCH WAS A SEA CREEK THEN. THE KUTCH ISLAND ACTED AS A BRIDGE BETWEEN SINDH AND KATHIAWAR. KUTCH AND KATHIAWAR THEN WERE PARTS OF SINDH AND SO WAS SOUTHERN PUNJAB. THE HAKRA RIVER (SARSUITI) WAS ACTIVE THEN. THE EARLY SETTLEMENTS (PRE-HARAPPAN) WERE MOSTLY ALONG RAIN FED NAIS IN BALOCHISTAN AND KOHISTAN OF SINDH. ONLY AMRI AND KOT DIJJI WERE IN THE INDUS MEANDER PLAINS. THE NAIS OF SINDH SHOW MUCH EARLIER STONE AGE SITES. A NUMBER OF INDUS CULTURE (HARAPPAN) SITES HAVE BEEN FOUND ALONG SARSUITI-HAKRA SYSTEM.

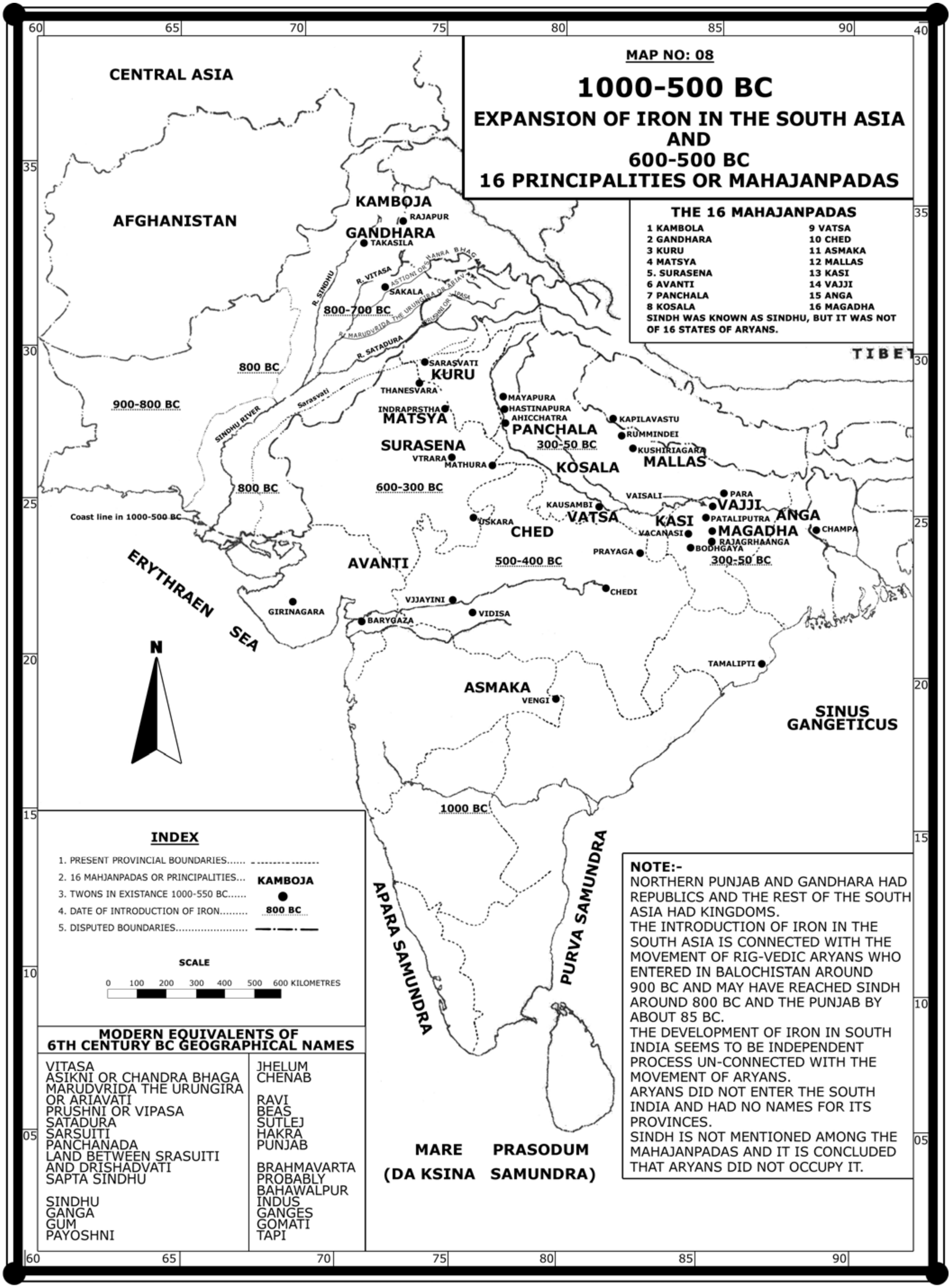
KUTCHI IS DIALECT OF SINDHI LANGUAGE LIKE SIROLI, WICHOLI, THARI. LASSI AND LARI. MANY CASTES AND TRIBES OF KUTCH ARE THE SAME AS THOSE IN SINDH AND SOME STILL ARE HINDUS AND OTHERS MUSLIMS IN KUTCH. JAREJA SAMMAS FROM SINDH RULED KUTCH FROM 1148 TO 1948 AD. POPULATION OF SINDH, KUTCH, KATHIAWAR AND GUJARAT IS CLASSIFIED AS INDO-SCYTHIANS HAVING CORNICE INDEX OF 0.71 LIKE THAT OF MOHENJO-DARO. COMMUNICATIONS AND CULTURAL TIES BETWEEN SINDH AND KUTCH STARTED DETERIORATING IN THE THIRTEENTH CENTURY BUT COMPLETELY STOPPED AFTER 1965 WAR BETWEEN INDIA AND PAKISTAN IN RANN OF KUTCH.

MAP NO: 07

2500 - 1000 BC
THE EXTENT OF EARLY, MATURE AND DECLINING INDUS CIVILIZATION



INDUS CIVILIZATION HAS ITS GENESIS IN MEHRGARH, WHICH FROM 6500 BC (7000 BC?) TO 2500 BC EVOLVED LEADING INTO AMRIAN (3700 BC) AND KOT DIJJIAN (3300 BC) CULTURES TO THE EARLY INDUS CIVILIZATION TO MATURE INDUS CIVILIZATION (2350 – 2000 BC). THEN IT DECLINED TO JHUKAR (CEMETERY H) AND JHANGAR CULTURE, FROM 3000 -1300 BC AND 1300 – 900 BC. THE WHOLE CIVILIZATION WAS INDIGENOUS WITH VERY LITTLE CONTACTS OUTSIDE AND LIMITED TRADE, WHICH MAY HAVE BROUGHT NEW IDEAS INCLUDING GERMPLASM OF WHEAT AND BARLEY AT MEHRGARH.


MAP NO: 08
1000-500 BC
EXPANSION OF IRON IN THE SOUTH ASIA
AND
600-500 BC
16 PRINCIPALITIES OR MAHAJANPADAS
THE 16 MAHAJANPADAS
1 KAMBOLA
2 GANDHARA
3 KURU
4 MATSYA
5. SURASENA
6 AVANTI
7 PANCHALA
8 KOSALA
9 VATSA
10 CHED
11 ASMAKA
12 MALLAS
13 KASI
14 VAJJI
15 ANGA
16 MAGADHA
SINDH WAS KNOWN AS SINDHU, BUT IT WAS NOT OF 16 STATES OF ARYANS.
CENTRAL ASIA
AFGHANISTAN
KAMBOJA
RAJAPUR
GANDHARA
TAKASILA
R. VITASA
SAKALA
R. SINDHU
800-700 BC
R. SATADURA
800 BC
900-800 BC
SARASVATI
KURU
THANESVARA
Sarasvati
SINDHU RIVER
INDRAPRSTHA
MATSYA
MAYAPURA
HASTINAPURA
AHICCHATRA
PANCHALA
300-50 BC
KAPILAVASTU
RUMMINDEI
KUSHIRIAGARA
MALLAS
SURASENA
VTRARA
MATHURA
KOSALA
TIBET
800 BC
600-300 BC
Coast line in 1000-500 BC
KAUSAMBI
VATSA
VAISALI
PARA
VAJJI
ANGA
PATALIPUTRA
KASI
MAGADHA
CHAMPA
VACANASI
RAJAGRHAANGA
BODHGAYA
USKARA
CHED
PRAYAGA
300-50 BC
ERYTHRAEN
SEA
AVANTI
500-400 BC
CHEDI
GIRINAGARA
VJJAYINI
VIDISA
BARYGAZA
N
TAMALIPTI
ASMAKA
VENGI
SINUS
GANGETICUS
1000 BC
INDEX
1. PRESENT PROVINCIAL BOUNDARIES......
2. 16 MAHJANPADAS OR PRINCIPALITIES... KAMBOJA
3. TWONS IN EXISTANCE 1000-550 BC......
4. DATE OF INTRODUCTION OF IRON......... 800 BC
5. DISPUTED BOUNDARIES......................
SCALE
0 100 200 300 400 500 600 KILOMETRES
APARA SAMUNDRA
PURVA SAMUNDRA
NOTE:-
NORTHERN PUNJAB AND GANDHARA HAD REPUBLICS AND THE REST OF THE SOUTH ASIA HAD KINGDOMS.
THE INTRODUCTION OF IRON IN THE SOUTH ASIA IS CONNECTED WITH THE MOVEMENT OF RIG-VEDIC ARYANS WHO ENTERED IN BALOCHISTAN AROUND 900 BC AND MAY HAVE REACHED SINDH AROUND 800 BC AND THE PUNJAB BY ABOUT 85 BC.
THE DEVELOPMENT OF IRON IN SOUTH INDIA SEEMS TO BE INDEPENDENT PROCESS UN-CONNECTED WITH THE MOVEMENT OF ARYANS.
ARYANS DID NOT ENTER THE SOUTH INDIA AND HAD NO NAMES FOR ITS PROVINCES.
SINDH IS NOT MENTIONED AMONG THE MAHAJANPADAS AND IT IS CONCLUDED THAT ARYANS DID NOT OCCUPY IT.
MODERN EQUIVALENTS OF
6TH CENTURY BC GEOGRAPHICAL NAMES
VITASA — JHELUM
ASIKNI OR CHANDRA BHAGA — CHENAB
MARUDVRIDA THE URUNGIRA OR ARIAVATI — RAVI
PRUSHNI OR VIPASA — BEAS
SATADURA — SUTLEJ
SARSUITI — HAKRA
PANCHANADA — PUNJAB
LAND BETWEEN SRASUITI AND DRISHADVATI — BRAHMAVARTA PROBABLY BAHAWALPUR
SAPTA SINDHU
SINDHU — INDUS
GANGA — GANGES
GUM — GOMATI
PAYOSHNI — TAPI
MARE PRASODUM
(DA KSINA SAMUNDRA)

This is hardly true as some of contemporary settlements of Mohenjo Daro period like Allah Dino were close to sea.

The climatic information of north-eastern Africa (Libya, Egypt and Ethiopia) shows that rain fall was plentiful from 9,200 - 6,000 BC and second wet period; after short arid period from 5,000 - 2,350 BC by end of which time the present aridity was established in those areas, but not in Sindh. Studies of climate of Rajasthan show less rain fall from 4,200 - 3,800 BC. This probably was the period of construction of Gabarbands in Sindh and also moving of man to the Indus plains where Amrian culture was established. Occupation of many sites in Kohistan is connected with availability of perennial spring water from forty-two major springs, which supported settlements near them before, during and after Amrian times. The discharge of springs must have been multifold of the present as rains then were at least two-and-half times as at present. Rain water that percolates down the fissures and cracks in the rocks is discharged slowly by springs. Unlike “Sailabi" cultivation on preserved moisture spring water must have been led to fields for irrigation by small channels and this could be the first beginning of irrigation and an example for starting canal irrigation.

Construction of Gabarbands to lead rain water to pre-embanked fields could be considered as another method of rudimentary irrigation though water was applied to the field only once even before sowing the seed.

Recent studies of rudimentary methods of irrigation used even now in the Indus riverine area show that they may have been invented and practised in the Amrian times and needs to be described.

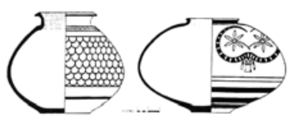
It consists of complex water management from Wahur, Dhoro and Dhori, which are from big to small in size and originate from abandoned channels of the River Indus. Wahurs are recently abandoned channels, a few miles long and are connected to the main channel. If a Wahur is nine miles long and is connected with the river at top end and not along its whole length it will have water six feet higher than main channel at its tail end due to average slope of eight inches to one mile of the river as well as of the land if natural embankments of Wahur are well developed. Thus, Wahurs can be used for gravity irrigation at suitable points. Water enters Wahur from the main river channel in the inundation season or even when water recedes, but Dhoro or Dhori are not connected to the main course or the river or Wahur. Water is led from Wahur to Dhoro by cutting a small channel, which fills Dhoro to the level of Wahur at the point of cut. From Dhoro water is led to Dhori to fill it up. From Dhori water is led to small fields, each four to eight acre area, having dish shape and below the level of the Dhori. Dhoros remain filled with water to varying degrees and nowadays water is lifted from them for raising summer and winter crops.

Before settling in the Indus plains Amrians must have found the Indus as source of water for raising crops, silt in its water as an ingredient of fertility and its water as a source for fisheries. Convex flood plains were marked by levees, which formed the natural river channel banks. The Indus usually reached its peak flows in the second fortnight of July at Guddu and 8-10 days later at Kotri. It would fill most of low spots in its plains before end of July and flow of water to depressions would be cut off at end of September.

In the Amrian and later on in the mature Indus civilisation times the depressions were drained in October and by mid-November all the lowest basin hollows were exposed for Rabi crops. The fish left stranded in the shallow water pools was associated with Amrian fishing industry. Fish could be caught easily with spears, nets, Kurhis or basket nets or even by hand and this is probably what the early man everywhere did. Archaeologically it is difficult to identify fish remains specially to classify satisfactorily various fishes as their cranial elements are more subject to damage by post-depositional process. Fishing probably was most important activity of the man in Sindh since Amrian times, but fisherman were considered a low caste by the later vegetarians. They formed a vast number of villages close to the River Indus and around lakes created by it during the annual inundation. Coastal sea fisheries too were common. Fish probably was also caught in large quantities and dried and sold.

FISHING TACKLE USED IN SINDH DURING AMRIAN TIMES

Archaeological evidence of fishing tackle is lacking, but considering the evolution of tools elsewhere it would be fair to assume that the earliest fishing tool was spear; a point hafted or point with socketed head like that of harpoons.



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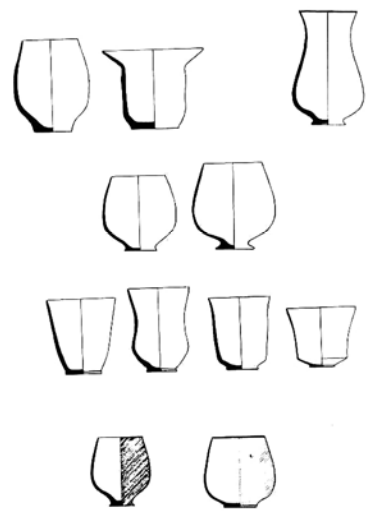

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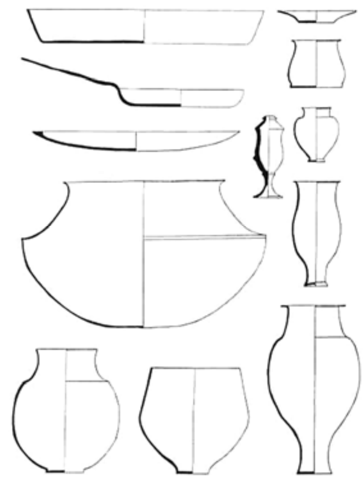

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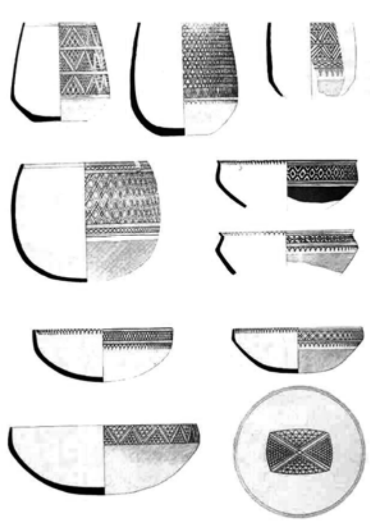

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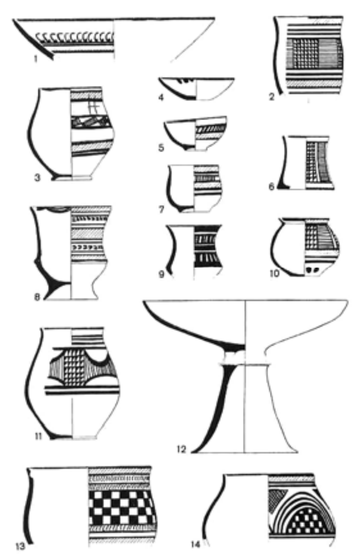

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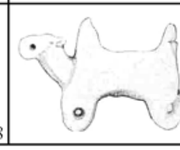

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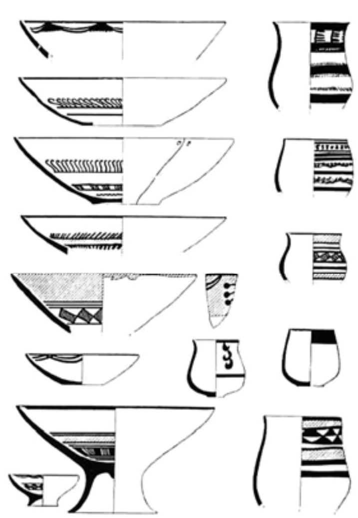

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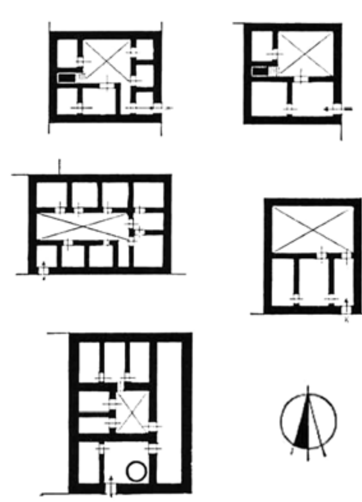

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POTTERY, TOOLS AND HOUSE PLANS

270. Early Indus pottery, Kot Dijji, 3300 BC
271. Plain pottery from Mehrgarh, 2700 BC
272. Copper and bronze vessels, Mohenjo-daro, 2500 BC
273. Copper and bronze tools, Mohenjo-daro, 2500 BC
274. Painted pottery, Pirak, period II, 1800 BC
275. Painted pottery from Amri, 1-10 and 12 period IB, 11, 13 and 14 period IC, 3700 BC
276 & 277. Pirak painted pottery, 1800 BC.
278. Stone notched blade, 1800 BC.
279. Terracotta bactrian camel,1800 BC.
280. Compartmented building of mud-bricks, Mehrgarh (MR 4), 7000 BC
281. Painted pottery from Amri, period IA, 3700 BC
282. Mohenjo-daro typical house plans, 2500 BC

CHAPTER 9

AGRICULTURE AND SAILABI TYPE RUDIMENTARY IRRIGAITON IN THE EARLY AND THE MATURE INDUS VALLEY CIVILISATIONS; 3,770 - 2,350 AND 2,350 - 1,650 BC

This period could be divided into: Amrian civilisation, starting around 3,770 BC; Kot Dijji, around 3,300 BC and Mohenjo Daro 2,360 - 1,650 BC at the end.

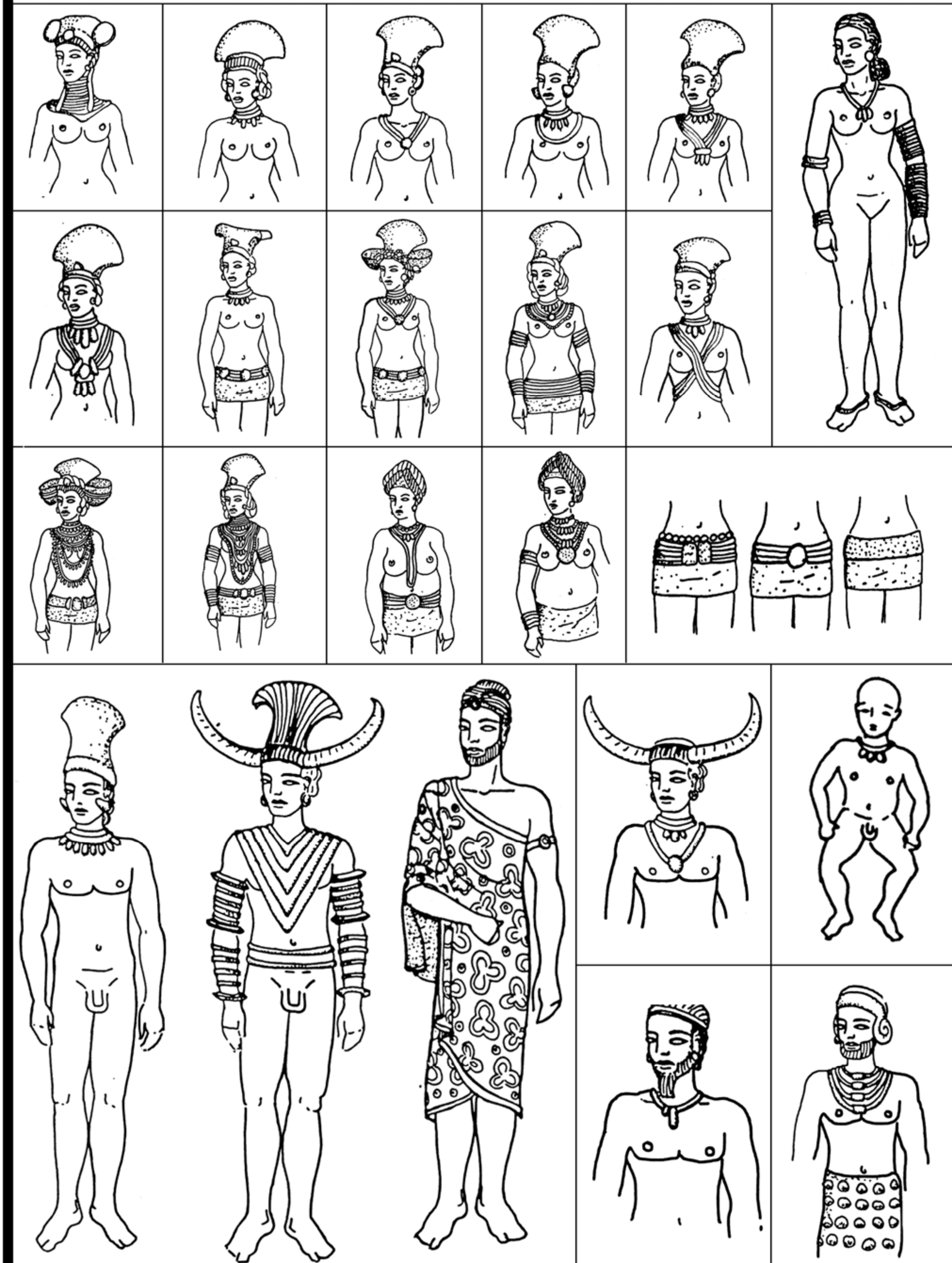
Communities living in Anatolia (Turkey) had started domesticating plants (wheat, barley and leguminous crops), sheep and goat before 7,000 BC, but they were also depending on food-gathering from wild plants and hunting. Full time hunter-food-gatherers also existed side by side. Almost simultaneously domestication of cattle and plants started at Mehrgarh. The previous thinking that Indus culture was based on borrowings from outside stands superseded. There have been local developments from 7,000 BC onwards. It is safe to presume that rudimentary canal irrigation was known and practised at the time people settled at Amri around 3,500 BC, as discussed in the previous chapter.

About this time the rudimentary irrigational civilisation combined with animal breeding, fishing and occasional hunting and food-gathering in the valleys of the Nile, the Tigris-Euphrates and the Indus were able to produce agricultural surplus large enough to support specialists in some trades relieving them from food production. Water transport and wheeled vehicles made it easy to transport food to various places. Thus rose early cities. Population of Egypt doubled between 4,000 and 3,000 BC. It is safe to assume that population of Sindh had reached 250,000 by mid-Kot Dijjian times and by the beginning of Mohenjo Daro i.e. around 2,350 BC it may have reached 500,000 people in the alluvial plains of Sindh alone. In the next 300 years the figure must have doubled for Sindh as it got saturated with people who probably started migration to the Sarsuiti valley and Gujarat. Sindhis have always migrated to Kutch, Kathiawar and Gujarat when under economic pressures.

The initial form of seed bed preparation in Amrian and Kot Dijjian times must have been clearance of forests in the Indus flood plains by slush and burn system. On this land agricultural crop is grown for a few years and then land is left fallow for quick growing trees to attain a good height when they are cut again. Burning was to be carried out just before inundation season for silt and water of the rising river to bury the organic material. On this porous soil crops were grown without further seed bed preparation. By the beginning of the mature Indus times (2,350 BC) wheeled car as well as the harrow were already in use having been introduced during Kot Dijjian times after 3,000 BC. Remains of plough or harrow have also been found from Mohenjo Daro. A seed drill of the type engraved on terracotta seal from Lothal could be an implement developed during Indus culture. The regular plough probably was developed 300 years later between 2,100 and 2,000 BC. The use of toothed harrow shows that “slush and burn” method was no longer used due to pressure of population on the land. By the time “slush and burn system” was discarded population may already have reached 500,000 and yet irrigation system may have remained rudimentary. At the beginning of second millennium BC Sindh could support population of one million people, but end of this civilisation was already on the anvil.

The evolution of toothed harrow and plough and universal use of bullocks as draft animals around 2,300 BC must have helped in reclamation of more areas, population growth and development of at least irrigation for supplementing moisture in riverain areas and raising crops on spring water or from depressions and Wahurs.

283.TRADITIONAL ORNAMENTS WORN BY MEN AND WOMEN DURING INDUS CULTURE TIMES AND SOME CONTINUED DURING SOOMRA RULE AND AFTER (JONATHAN MARK KENOYER)



THE EXTENT OF INDUS CIVILISATION AND ITS IRRIGATED AREAS

An impression is given that the Nile and Tigris-Euphrates valley cultures were most advanced and flourished on a much more grand scale while the Indus valley was an off shoot of Mesopotamian culture. Looking to the extent of areas occupied by the Mesopotamian and the Egyptian cultures at their maximum extent they hardly occupied one tenth of the area of the Indus culture. The latter covered about half a million square miles and survived more than 5,500 years from rise of Mehrgarh to disappearance of Jhangar culture i.e. 6,500 to 1,000 BC. It was neither an off shoot nor a copy of the other two. The common feature was water management for raising crops except in the southern most province of Indus valley consisting of Kutch, Kathiawar and northern Gujarat where rain-fed agriculture was practised though even there recent evidence of tank as well as well irrigation by means of shaduf or Boka at Lothal has come up. The eastern most sites of the Indus culture are Rupar in east Punjab and Alamgirpur in UP. The southern-most site is Bhagatra near the mouth of the Nurmada River. The northern most site is Harappa near Faisalabad. In the west Mundigak in Afghanistan and Shahi Tump near Turbat in Balochistan form its boundaries. Map enclosed shows the Indus valley and its settlements. Recent exploration has further enlarged the area under the Indus civilisation.

The Indus culture spread from its nucleus in Balochistan, Sindh and the south-western Punjab to Saurashtra and the east Punjab around 2,000 BC not due to greater potential for growing wheat and cotton in those areas, as stated by Lambrick (1973), but because of pressure of population. Those areas were definitely not as attractive as Sindh.

Use of wheat (tritium sphaerococcoid), barley (hordeum vulgare), cotton (gossypium) and peas (pissum arvense) was common in the Indus valley while mustard (barassica sp.) and sesame were occasional. Rice (oryza sativa) was common in Maharashtra after 1,600 BC and was being cultivated in Saurashtra and west Rajasthan between 2,400 - 1,750 BC, but its existence in Sindh has not been proved archaeologically. Rice was native to India and climatic conditions and availability of water in the growing season make it a point that it may have grown in the whole of the Indus valley during Jhukar, Cemetery H and Pirak era. Rice has been found in Saurashtra and Rajasthan. Wheat and barley have not been recorded from Harappa site itself. Banana and sugarcane are two other crops, which have left no trace in the archaeological records, but may have been grown in Sindh. Cotton, a summer crop, was not only grown at Mehrgarh around 4,500 BC, but its end products; textiles as well as manufacturing craft at the time of mature Indus culture technologically were well advanced. Excavation at Kalibangan shows that ploughing pattern with use of drill and for mixed cropping in winter season was well established by 2,000 BC.

The existence of cotton, which until the seventeenth century was a perennial shrub, as recorded by Marco Polo in 1,290 AD, Rashiduddin in 1,310 AD and Terry in 1,615 AD and which in 1787 AD became rare according to Dr. Hove proves with certainly that some areas in Sindh were perennial where cotton was grown. Cotton existed at Mehrgarh in the Indus valley in 4,500 BC and was carried over to mature Indus culture 2,000 years later in the form of small tress as has been recorded by Mirak in the early seventeenth century.

Cultivated rice of declining Indus culture (sativa indicia) descended from cross breeding of wild perennial variety 'rufipagon' and wild annual variety 'nivara'. From their original home in UP in India the varieties spread to whole south and south-east Asia much before the Indus culture. Their presence in the Indus culture therefore would be a conjecture and archaeologically not unearthed.

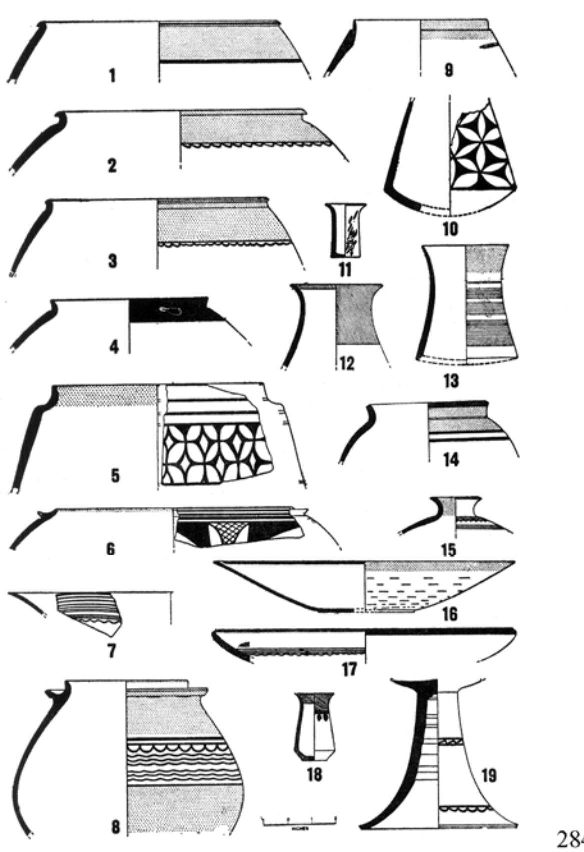
SAILABI CULTIVATION

The consequences of Sailabi cultivation in the riverain areas as well in depressions in the Indus plains and rudimentary irrigation were: extensive agricultural society urbanisation at Mohenjo Daro with parallels; Karachi, Malir, Chanhujo Daro, Kot Dijji, Luhamjo Daro and Harappa in Sindh; Lothal in Gujarat and Kalibangan in Bikanir.

Commonly grown varieties of wheat by Sailabi cultivation were: six row small seeded wheat (horedeum vularge varnudum) at Harappan sites; Indian dwarf wheat (tritium sphaerococcoid) and sub-species of six row small seeded wheat (horedeum valgavre vernudum). Rai, a species of brassica was also grown in the Indus valley and cloth was produced from Gossypium arboretum, a domesticated variety of cotton. Cotton later on called Sindhon by Greeks actually comes from the word Sindhu.

SHADUF FOR IRRIGATION IN MATURE INDUS TIMES

Shaduf or Boka is still used near Lothal. (Loth in



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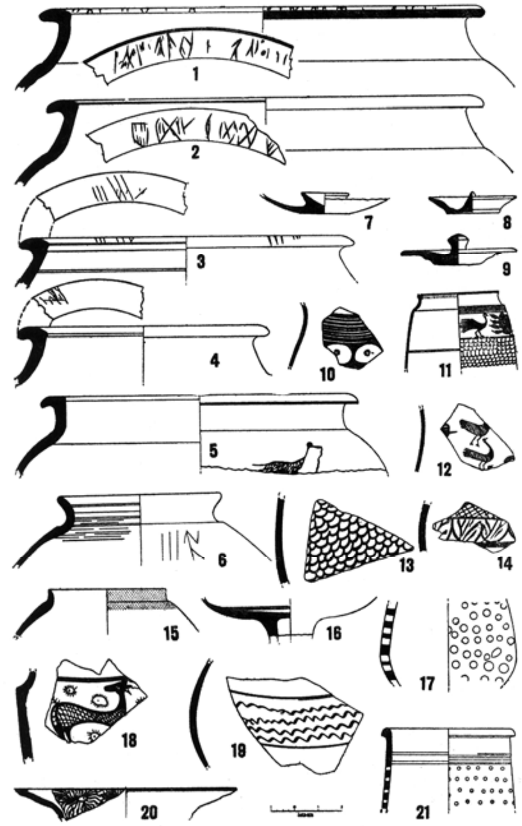

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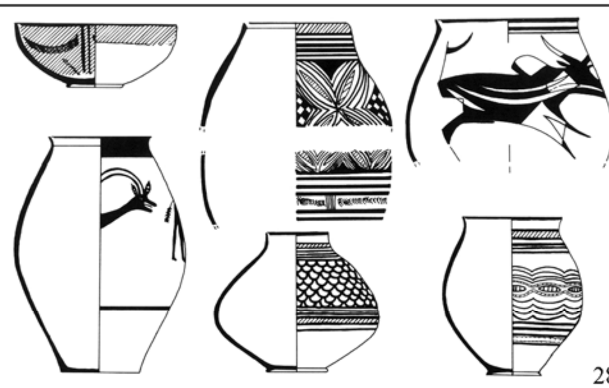

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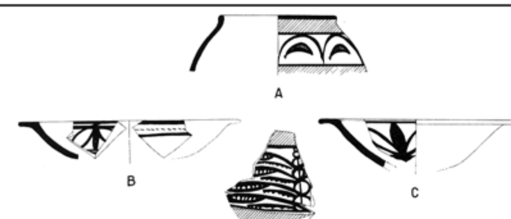

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GEOMETRICAL DESIGNS AND MOTIFS ON POTTERY

284. Vases and globular vessels with averted, under-cut and flanged rims
285. Neck pieces, painted and inscribed shreds, perforated vases and lids
286. Cemetery H pottery motifs from Harappa, 2500 BC
287. Pottery from Amri, period ID
288. Jhukar pottery
289. Amri pottery: A, late Amri period; B and C Intermediate period

Gujarat means dead and Lothal means mound of dead exactly what Mohenjo Daro means). On Mohenjo Daro seals there is a linear representation of a man using shaduf (Marshall 1931: 389). Ring-stones found at Mohenjo Daro having slots were probably used to fasten stones to something that passed through the holes. These may well have been shaduf counter weights unless alternate use is known. A post-hole found near a well in Lothal may as well have been meant for shaduf. A 20 acre tank without steps near Dhanduka, not far from Lothal, belonging to the same age as reported in archaeological survey of India Western Circle (1879) may have a tank filled with rain water for irrigation. Watercourse traces have also been found at Lothal.

Wheeler (1960) and Drower (1958) believe that Indus valley had some kind of irrigation though direct evidence is lacking. Indigenous irrigation in south India from tanks is practised till this day. Some of the south Indian tanks cover nine to ten square miles (Buckley 1893). The Lothal tank has capacity of five thousand cubic metres. Rain fall around Lothal is about 700 - 800 mm (over a period of 5-6 months) annually. There is deficiency of water for about 6-7 months. The above tank could have been filled 3-4 times a years. Thus raising its capacity to 15,000 - 20,000 cubic metres. If actual rain fall is 700 - 800 mm and if three vegetable crops are grown a year, 1500 - 1800 mm of water is required. Deficiency of water could be about 800 mm. The tank therefore could irrigate about 20,000 square metre area or two hectares (five acres).

GABARBANDS

Gabarbands in mature Indus culture in Balochistan and western Sindh were not storage dams (Stein 1931, Marshal 1931) in the true sense. Being in the porous gravel fans they served the purpose of check dams for creating overflow in adjoining cultivable land or even producing additional cultivable land. This is still a popular practice in Balochistan. The present writer increased a fleet of 6 bulldozers in 1958 to 117 by 1969 for diversion of water to the pre-embanked fields from porous check dams, successors of Gabarbands in Balochistan, reclaiming one hundred thousand acres.

The abandonment of Gabarband system may be due to desertification of the area owing to over grazing and reduction of rain fall. After Gabarband system, came the Karez type water galleries or horizontal underground tunnels. This method was more reliable and worked for centuries once completed. The construction and operation of Karez has been discussed in author's book “Ground Water” (1964). The Karezes could have attracted people from ‘Sailabi’ type cultivation practised under Gabarband system and led to abandonment of the latter. Both Karez and Gabarband cultivations are uneconomical if practised on hired labour. They could only fit in pastoral and part time cultivator economy, which could provide labour almost free seasonally.

EXPORT ITEMS

Major item of irrigated products in Kot Dijjian times (3,000 BC) and onwards was cotton textiles followed by wood and a minor item possibly henna. The last one originated in Orisa and probably was grown in Sindh. It found its way by export to Mesopotamia and from there to Egypt where Pharaohs applied it to feet, nails and hands, as some mummies show.

WEIGHTS AND MEASURES

The weights and measures as means of agriculture and other trades vary in size from 1.1 x 1.1 x 0.7 centimetres to 4.1 x 4.1 x 3.4 centimetres. The mean weights are found in the simple ratio of 2, 4, 6, 8, 16, 32, 64 and 120 (Mackay 1938 p. 601). This biennial system is also superimposed with decimal system. The system was in vogue in South Asia up to 1962 AD in form of currency of one rupee having 192 pies, 64 paisas and 16 annas, which were further divided into 8, 4, 2 and 1 anna pieces. The weights were similarly divided into one Maund = 40 Seers = 160 Paos and Pao = 20 Tolas. Tola had 12 Masas etc. Volume was measured as: one Kharar = 60 Kasas; One Kasa = 4 Toyas; One Toya = 4 Patis and One Pati = 4 Chothras.

TRANSPORT OF AGRICULTURE PRODUCTS

Transport of products in the inland was by bullock carts and where convenient by boats after goods were brought to ports by carts. Horse was not domesticated at Mohenjo Daro. The bones of animal found there are those of semi-ass. Ass (equns asinus) was domesticated in Egypt and Onager (equenus hemi onus hemippus) is known for pulling vehicles in Mesopotamia around 3,000 BC. Semi-ass of Mohenjo Daro may be onager or semi-ass and may have been used as pack animal or in carts.

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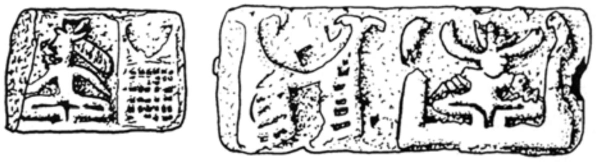

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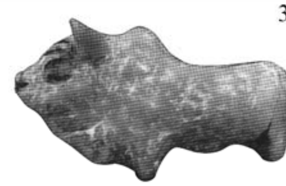


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CLAY TOYS AND OTHER OBJECTS

290. Seated figure or deity with reed house or shrine at one side, Harappa, 2500 BC
291. Humped bull figurine with molded head twisted to the side and terracotta mold for making bull figurine heads, Mohenjo-daro, 2500 BC
292. Painted shred with stylized bull motif, Mehrgarh, period III, Kili Gul Muhammad ware, 2500 BC
293. Humped bull figurine of terracotta stone from sector K 3/4 E, period VIIB
294. Fat woman figurine with turban-like headdress, Nausharo, 2500 BC
295. Seated woman grinding grain, Nausharo, 2500 BC
296. Animal figurine from fourth period (period VII)
297. figurine of a sheep in terracotta, area MR 2, period IIIC
298. terracotta bull figurine with red and black paint from loc. CXVIII, area MR 1, period VII
299. Animal figurine from third period (period VI)
300. Hollow egg-shaped and bird figurine whistles from Nausharo, 2500 BC
301. Humped bull figurine in terracotta, area MR 2, period IIIC, Mehrgarh
302. Animal figurine from fourth period (period VII), Mehrgarh
303 & 304. Humped bull.
305. Hollow seated ram figurine with hole in the centre of back, Mohenjo-daro, 2500 BC
306. Terracotta figurine of a camel from Pirak, Balochistan, period 2500 BC
307. Onager (Equus hemionus) figurine, Nausharo, 2500 BC
308. Terracotta figurine of a horse from Pirak, Balochistan, period 2500 BC

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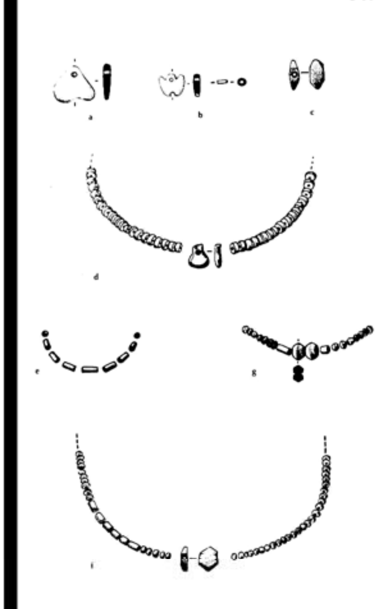

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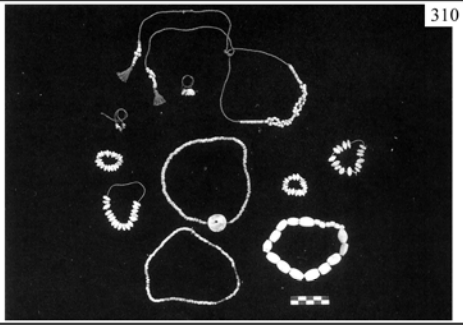

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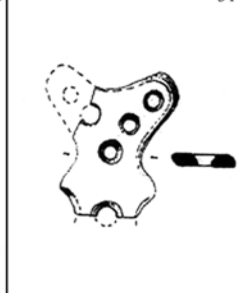

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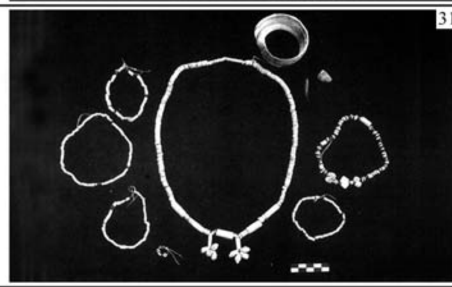

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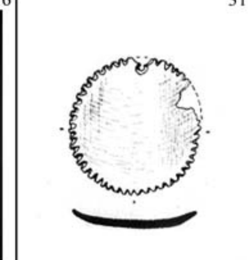

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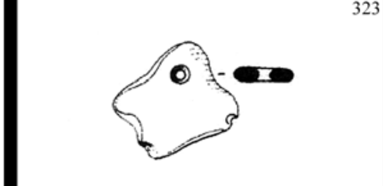

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ORNAMENTS

309. Jewelry 5500 BC
310. Ornaments of shell, turquoise, steatite and other semi-precious materials from Mehrgarh, Area MR 3, period IB
311. Reconstructed from blades found in grave 114, period IB, Mehrgarh.
312. Ornaments, period IA, Mehrgarh.
313. Mehrgarh, bone tool made of Barasingha antler. Area MR 3 South, period IA
314. Bone pendant from MR 3 F D 6F, period IB, Mehrgarh.
315. Reconstructed belt, period IA, Mehrgarh.
316. Goods drawn in fig. 6.2, period IA, Mehrgarh.
317. Shell pendant from MR 3 F D 8E, period IA, Mehrgarh.
318. Shell beads and copper bead from grave 101, period IB, Mehrgarh.
319. Bone rings and shell ornaments from MR 3 T, grave 12, period IA, Mehrgarh.
320. Copper bead and ring from MR 4 F6F (2), period IIB, Mehrgarh.
321. Mehrgarh sector MR U3 9C/D. Area MR 1, period VIII
322. Ornaments of bone from MR 4, period IIB, Mehrgarh.
323. Pendant of green stone MR 3 F D 10E, period IB, Mehrgarh.
324. 2 leather armlets coloured with yellow ochre, period IA, Mehrgarh.

Both men and women adorned themselves with ornaments long before Mesolithic and Neolithic revolutions. The materials used were; carnelian, onyx, agate, lapis lazuli, faience, steatite, natural glass substances, mineral crystals, antlers, bones of animals and fish, ivory, shell, stone, terracotta, copper, brass, bronze, iron, silver and gold. Silver and gold ornaments were like saving in bank and others were for decoration. Colour of ornaments depended on raw material. Local clay in Indus plains gives reddish colour, but clay from piedmont soils of the western hills of Sindh gives yellowish or greenish colour. Faience can be deep blue, blue, green, white and yellow. Bangles and necklaces go back to Mehrgarh times. These are plentiful at Mohenjo Daro. Terracotta bangles have not been collected from surface of sites as broken pieces are not collected by villagers or bought by museums. Stoneware can be white, creamy, yellow, reddish and grey. Molten silicon can be white. Shells are white, ivory is creamy white, fish bones are white, steatite is white and agate is greenish to white. Shell ornaments with intricate designs are found from Mohenjo Daro. Fired steatite becomes red with white lines. Carnelian is reddish. Lapis lazuli is deep blue and amazonite/fuchsite/quartzite are blue green. The materials for ornaments making in 10th to 14th centuries were the same as during Mohenjo Daro times. It is known that South Asians convert their savings in silver and gold, which are being imported since proto-historical times. Port of Sindh was Debal or Barbarican, through which Romans and Ptolemys of Egypt imported goods in exchange for gold and silver. Surface findings are usually broken pieces and people threw them away, thus only a few pieces have reached museums.

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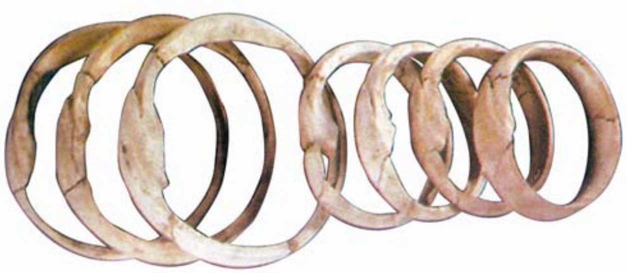

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BANGLES, BEADS AND PENDANTS

325. Faience bangle made in the shape of a shell bangle or the stylized (womb) motif, Harappa, 2500 BC
326. Painted Indus script on the inside of a bangle from Balakot, 2500 BC
327. Hollow bangles of hammered sheet gold, Mohenjo-daro, 2500 BC
328. Agate, jasper, green serpentine beads made in different shapes and designs, 2500 BC
329. Shell bangles from burial of an elderly woman from Harappa, 2500 BC
330. Inscribed bone rod from Mohenjo-daro, 2500 BC
331. Golden pendant with inscription from jewelry hoard at Mohenjo-daro, 2500 BC

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ORNAMENTS

332. Gold bead-caps, 2500 BC.
333. Gold stud from Harappa, 2500 BC.
334. Gold fillet, 2500 BC.
335. Gold broach from Harappa, 2500 BC.
336. Gold bracelet, 2500 BC.
337, 341 & 342. Necklace of beads, 2500 BC.
338 & 343. Etched beads, 2500 BC.
339. Gold bracelet, 2500 BC.
340,344 & 345. Shell bangle from Balakot, 2500 BC.

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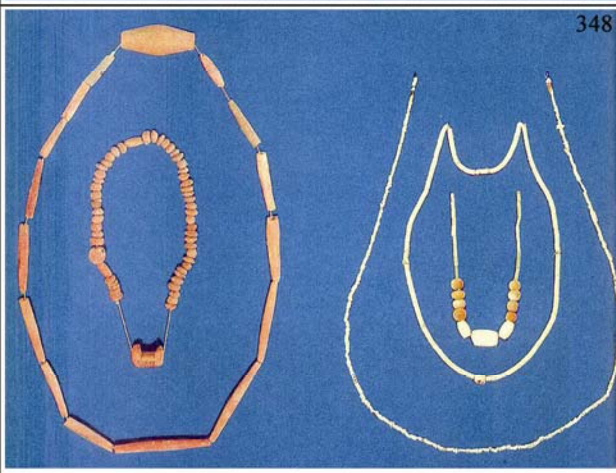

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ORNAMENTS AND TOILETERIES

346. Necklace or belt of carnelian and copper/bronze beads, silver necklace, coiled silver wire toe rings or finger rings, crumpled gold fillets and various pieces of gold ornaments, 2500 BC
347. Necklace/bracelet, 2500 BC.
348. Beads necklaces.
349. Belt or necklace made from carnelian and bronze beads, Mohenjo-daro, 2500 BC.
350. Bronze cosmetic container, 2500 BC.
351. Necklace of paste beads, 2500 BC.
352. Ivory comb, 2500 BC.
353. Paste bead-bracelet, 2500 BC.
354. Steatite pectoral, 2500 BC.

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TERRACOTTA, BRONZE AND SHELL OBJECTS

355. Terracotta disposable drinking cups with seal impressions. Mohenjo-daro, 2500 BC
356. Libation vessel from conch shell Turbinella pyrum, decorated with vermilion-filled incised lines, Mohenjo-daro, 2500 BC
357 & 358. Small painted globular pot and painted dish, 2500 BC
359. Tall jar with polychrome geometrical motifs, Mehrgarh, period 2500 BC
360. Bronze plates with vertical sides, Mohenjo-daro, 2500 BC
361. Three-sided molded terracotta tablet from Mohenjo-daro, 2500 BC
362. Dish-on-stand from the lower levels of Cemetery H. Harappa, 2500 BC
363. Large painted storage jar found in burned rooms at Nausharo, 2500 BC

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PAINTED POTTERY, TRAPS, STANDS AND SPOONS

364. Painted pot from Amri, 2500 BC.
365. Grey ware vessel, 2500 BC.
366. A few archaeological finds; there are figurines as well as pottery that the people in ancient times may have used.
367. Storage jar from Allahdino, 2500 BC.
368. Storage jar, 2500 BC.
369. Shell spoon, 2500 BC.
370. Terracotta trap, 2500 BC.
371. Dish on stand, 2500 BC.
372. Terracotta cakes. 2500 BC.
373. Painted jar from Amri, 2500 BC.
374. Painted vase, 2500 BC.
375. Elongated jar, 2500 BC.

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PAINTED POTTERY, STAND AND VASE

376. Painted vessel from Kot Dijji, 2500 BC.
377. Painted pot from Kot Dijji, 2500 BC.
378. Painted pot from Mohenjo-daro, 2500 BC.
379. Globular pot, 2500 BC.
380. Small pot, 2500 BC.
381. Grey ware vase, 2500 BC.
382. Dish on stand, 2500 BC.
383. Beaker, 2500 BC.
384. Perforated jar, Mohenjo-daro, 2500 BC.
385. Painted pot from Nindowari, 2500 BC.

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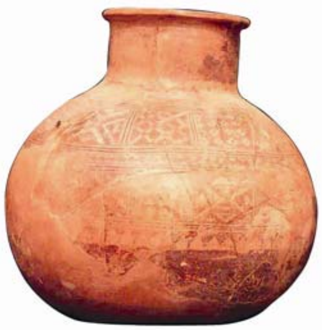

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DOMESTIC AND BURIAL POTTERY

386. Burial jar.
387. Miniature vase, 2500 BC.
388. Inscribed goblet, 2500 BC.
389. Pointed-base goblet, 2500 BC.
390. Painted pot, Pirak, period IA, CA, 1400 BC.
391. Globular jar, 2500 BC.
392. Miniature vase, 2500 BC.
393. Burial pot and grave pottery.
394. Painted pots, Mehrgarh, period V, 3300 BC.
395. Burial pottery.

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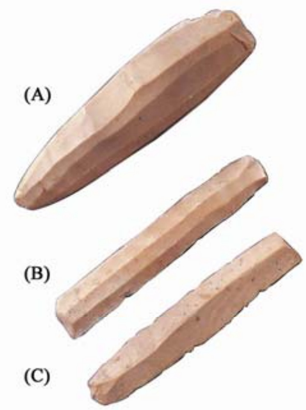

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TOOLS, BLADES AND ENTERTAINMENT

396, 397 & 400. Spear head, 2500 BC.
398. Copper objects, 2500 BC.
399. Knife and spade, 2500 BC.
401. Axe blade, 2500 BC.
402. Chert blades, stone implements, 2500 BC.
403. (A) Flint core, (B) flint blade (C) flint blade, 2500 BC.
404. Gamesmen, 2500 BC.
405. Various types of scale, 2500 BC.

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STONE AND METAL DETIES

406. The mother goddess, precursor of the Hindu Devi, 2500 BC.
407. The Phoenician goddess, Anath, 1177 BC.
408. Mother goddess, 600 BC.
409. Shiva and consort, 600 BC.
410. Rama, one of the incarnation of Vishnu, the Hindu god of preservation, 200 BC.
411. Vishnu as varaha-avatara, the boar incarnation, saving the goddess earth from the waters of the deep, 200 BC.
412. Shiva, 600 BC.
413. Vaikuntha, composite head of Vishnu, 600 BC.
414. Yashi, 500 BC – 01 AD.
415. Sandstone Yaksi, height 2.06 m, period 300 BC - 200 AD, Didargunj, Patna, (after S. P. Gupta), found from village near Pataliputra. She represents goddess of beauty. Such deities were produced from Mehrgarh times.
416. Masquette, 2500 BC.

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HUMAN AND ANIMAL FIGURINGS

417. Venus of Indus Civilization. Heavily adorned with graduated strands of chokers and pendant bead necklaces, Mohenjo-daro, 2500 BC
418. Nude male figurine or deity with wide spreading board, wearing a broken headdress that may have had two curving horns, Mohenjo-daro, 2500 BC
419. Male figurine or deity with goat-like beard, wearing a horned headdress (broken) Mohenjo-daro, 2500 BC
420. Female figurine holding an infant to her left breast, Mohenjo-daro, 2500 BC
421. Bronze figurine of a male spear-thrower or dancer, Chanhudaro, 2500 BC
422. Faience monkey figurine or amulet, Mohenjo-daro, 2500 BC
423. Large hollow bull figurine with braded halter, Mohenjo-daro, 2500 BC
424. Fighting dog with a projecting collar, Mohenjo-daro, 2500 BC

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HUMAN AND ANIMAL FIGURINGS

425. Female figurine, 2500 BC.
426. Male figurine, 2500 BC.
427. Naked man, 2500 BC.
428. Mother and child, 2500 BC.
429. Female figurine, 2500 BC.
430. Male figurine, 2500 BC.
431. Female figurine, 2500 BC.
432. Tiger's head, 2500 BC.
433. Masquette, 2500 BC.
434. Female head, 2500 BC.


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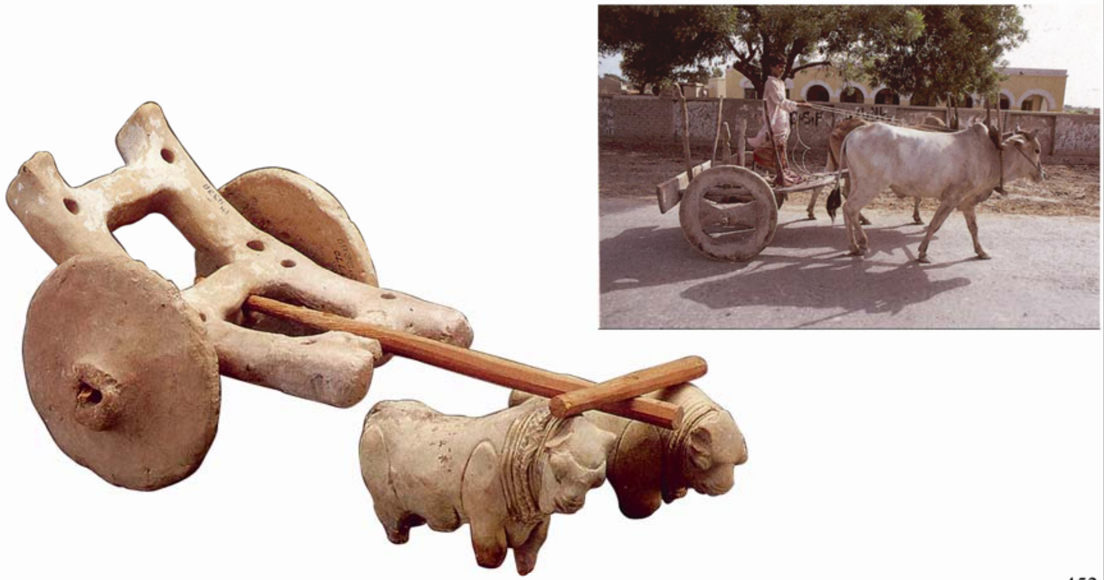
TOY FIGURINGS

435. Female figurings, 2500 BC.
436. Female figurings, 2500 BC.
437. Female figurings, 2500 BC.
438 & 439. Toy figures discovered at Mohenjo-daro.
440. Terracotta bird, 2500 BC.
441. Whistle bird, 2500 BC.
442 & 446. Terracotta toys, 2500 BC.
443. Bull's figurine, 2500 BC.
444. Figurine of monkey, 2500 BC.
445. Terracotta toy figurine, 2500 BC.
447. Copper/bronze ram figurine, 2500 BC
448. Bull's figurine, 2500 BC.
449. Terracotta horses, Pirak, period IA, CA, 1500 BC.
450. Rhinoceros, 2500 BC.
451 & 452. Bull's figurine, 2500 BC.



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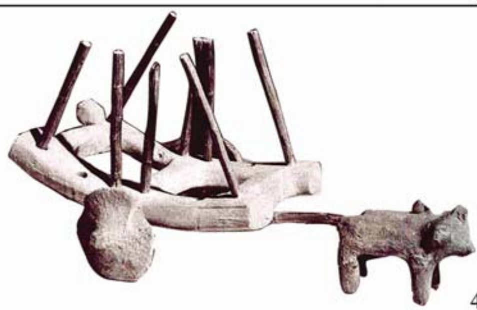

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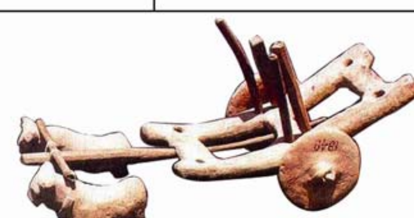

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TOY CARTS AND HUMAN FIGURINGS

453. Terracotta model of bullock cart, 2500 BC.
454. Clay toy cart, 2500 BC.
455. Bronze dancer, Mohenjo-daro.
456. Bronze dancing girl, 2500 BC.
457. Terracotta art, Mohenjo-daro, 2500 BC.
458. Head of an old man, 2500 BC.
459. Queen of Egypt, 30 BC.
460. Toy cart, 2500 BC.


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HUMAN, ANIMAL FIGURINGS AND WEIGHTS

461. The so-called priest-king of Mohenjo-daro, 2500 BC
462. Female figurine with traces of red pigment in the hair part, Nausharo, 2500 BC
463. Male figurine wearing an elaborate headdress and carrying a male infant, Nausharo, 2500 BC
464. Seated male figure with shell inlay in one eye, Mohenjo-daro, 2500 BC
465. Terracotta female figurine with elaborated coiffure and ornaments, Mehrgarh, 3000 BC
466. Seated limestone figure from Mohenjo-daro, 2500 BC
467. Carved sandstone head, Mohenjo-daro, 2500 BC
468. Truncated spherical weightfrom Mohenjo-daro, 2500 BC


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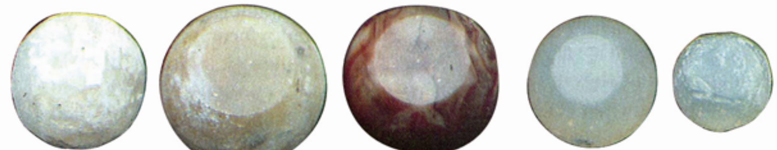
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HOUSING, IVORY AND STONE OBJECTS

469. Large compartmented mud-brick structures that may have been used for storage, Mehrgarh, 2500 BC
470. Carved ivory counters, Mohenjo-daro, 2500 BC
471. Traditional Sindhi houseboats on the Indus near Mohenjo-daro, 2500 BC
472. Steatite pendant from Mohenjo-daro depicting the mythical unicorn and many sacred symbols of the Indus religion, 2500 BC
473. Green stone (Fuchsite) tumbler from Mohenjo-daro, 2500 BC
474. Stone sculpture of a seated ram, Mohenjo-daro, 2500 BC
475. Hollow three-headed animal figurine, Nausharo, 2500 BC
476. Hollow three-headed animal figurine, Nausharo, 2500 BC

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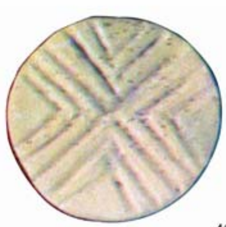

488

MOHENJO-DARO SEALS

477. Square steatite seal from Mohenjo-daro depicting a magnificent humped bull or zebu, 2500 BC
478. Steatite seal from Mohenjo-daro, clockwise from top left, 2500 BC
479. Water buffalo seal from Mohenjo-daro, 2500 BC
480. Steatite seal depicting a human figure in tree and a tiger looking back over its shoulder from below, Mohenjo-daro, 2500 BC
481. Steatite seal with horned tiger motif, Mohenjo-daro, 2500 BC
482. Worn steatite seal with multiple creatures combined to make a single animal, Mohenjo-daro, 2500 BC
483. Steatite seal depicting a deity standing in a l tree looking down on worshipers and a giant ram, Mohenjo-daro 2500 BC
484. Unfired steatite seal with a flat-bottomed boat incised on a steatite seal, Mohenjo-daro, 2500 BC

485 & 486. Two-sided seal with short-horned bull and swastika motif, Mohenjo-daro, 2500 BC

487 & 488. Geometric seals in terracotta and bronze from Pirak, Balochistan, 2500 BC

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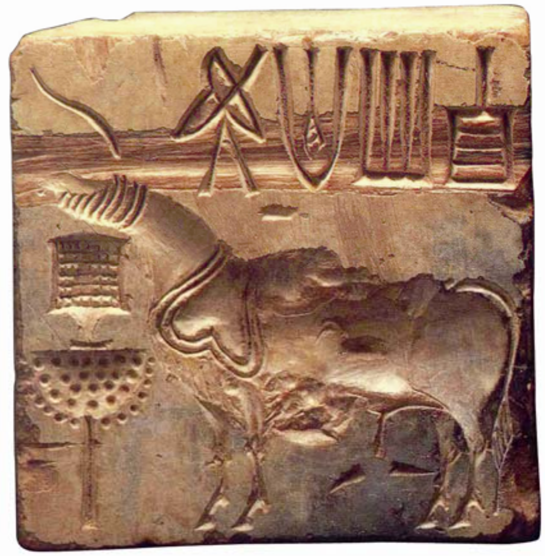

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MOHENJO-DARO SEALS

489, 490,495 & 499. Seals with Indus scripts, 2500 BC.
491. Sealing with tree deity, 2500 BC
492. Seal depicting a Unicorn, 2500 BC.
493,497, 498, 502 & 505. Seals with animals and deities, 2500 BC.
494. Seal with elephant, 2500 BC.
496. Terracotta round seal, 2500 BC.
500. Terracotta sealing with unicorn, 2500 BC.
501. Steatite seals with animal designs and inscriptions.
503. Steatite seal, 2500 BC.
504. Seal with (Enkidu) scene, 2500 BC.


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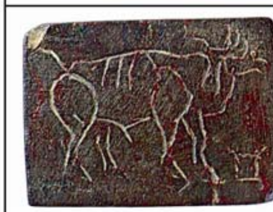
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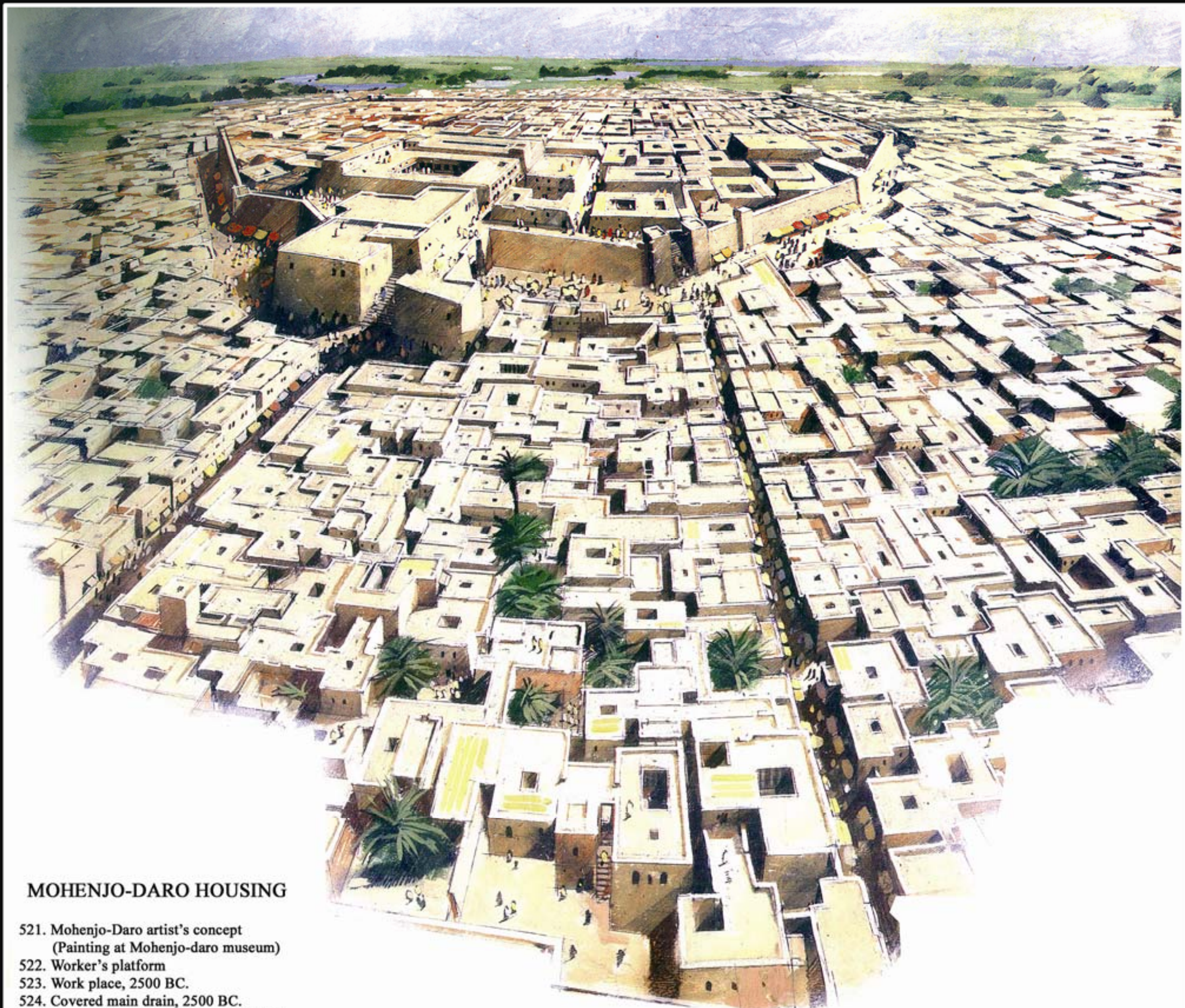
POTTERY, CERAMICS, SEALS, TABLETS AND STONE OBJECTS

506. Intersecting-circle motif variations on pottery from Mohenjo-daro, 2500 BC
507. Painted design in a bowl, Mehrgarh, period VII, 2600 BC.
508. Terracotta frying pan.
509. Copper pot, 2500 BC.
510. Painted goblet, Mehrgarh, period VII, 2600 BC
511. Ring stone, 2500 BC.
512. Bronze bucket, 2500 BC.
513. Fuchsite vase, 2500 BC.
514, 515 & 516. Terracotta seal, 2500 BC.
517. Seal, 2500 BC.
518. (A) Stone mortar, (B) stone pestle, 2500 BC.
519 & 520. Copper tablet, 2500 BC.



MOHENJO-DARO HOUSING

521. Mohenjo-Daro artist's concept
(Painting at Mohenjo-daro museum)
522. Worker's platform
523. Work place, 2500 BC.
524. Covered main drain, 2500 BC.
525. Lay-out the Mohenjo-daro, 2500 BC.
526. Corbelled arch drain, 2500 BC.

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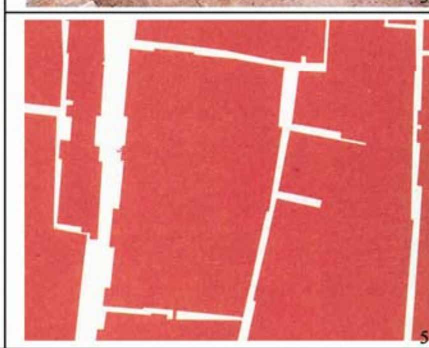

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TOWN PLANNING

527. The square blocks of the so called granary of Mohenjo-daro are visible in the background, and the great bath is in the foreground

528. The baked bricks buildings of Mohenjo-daro are grouped into different neighbourhoods linked by wide streets, such as first street in DK-G area, which is over 9 meters wide, 2500 BC

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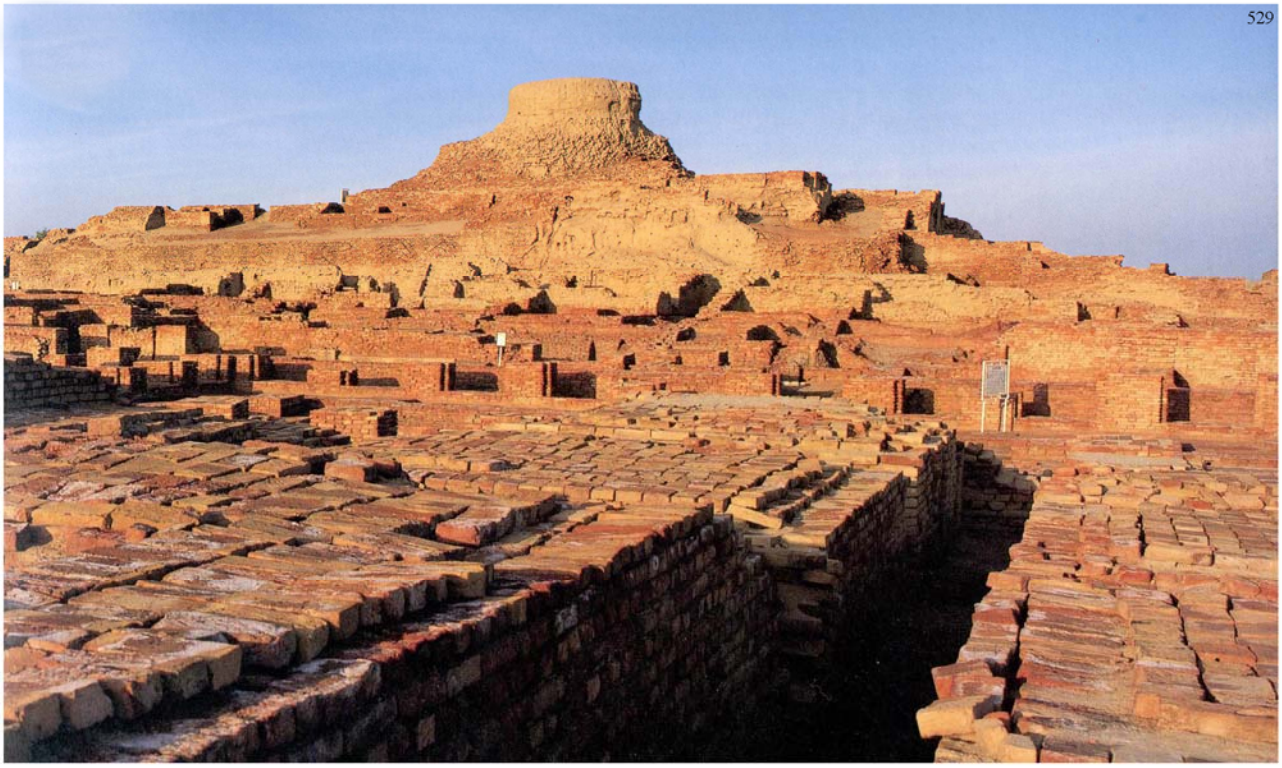

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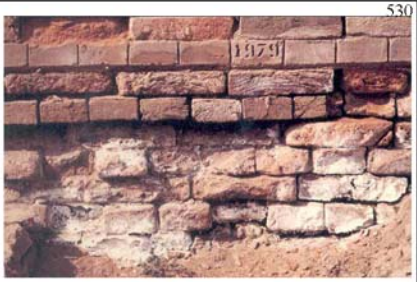

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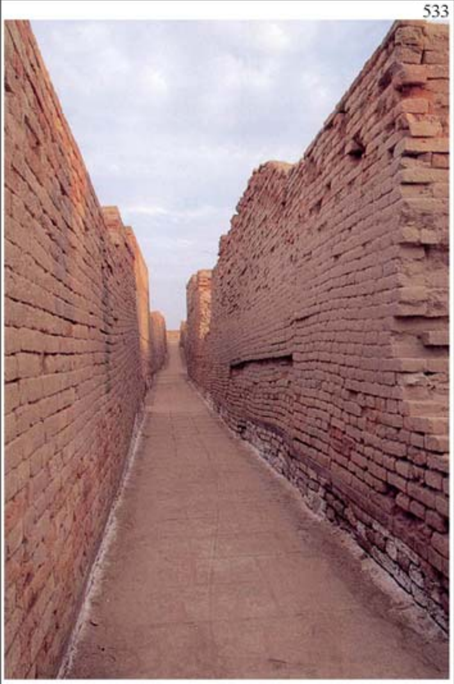

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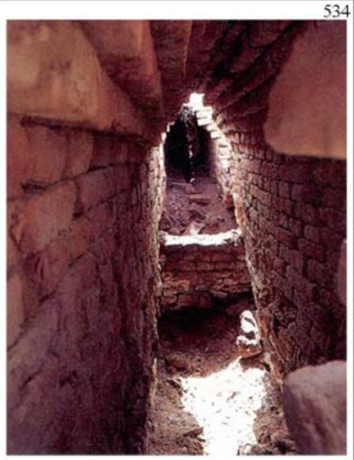

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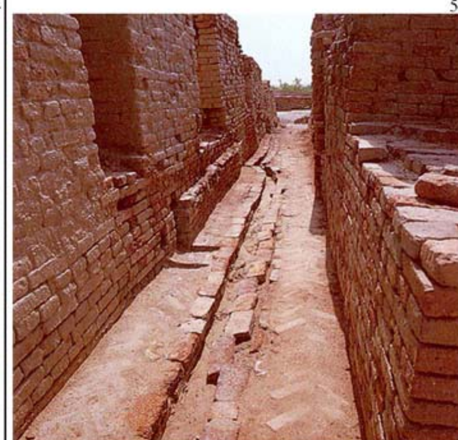

STRUCTURES

529. A general view of the stupa mound from the granary, 2500 BC.
530. Base of a wall showing the horizontal damp-proof course, 2500 BC.
531. Salt-affected wall along the main street, 2500 BC.
532. Architecture, simple and utilitarian, 2500 BC.
533. Low Lane in Lower City, 2500 BC.
534. Covered drain.
535. A street with drain, 2500 BC.

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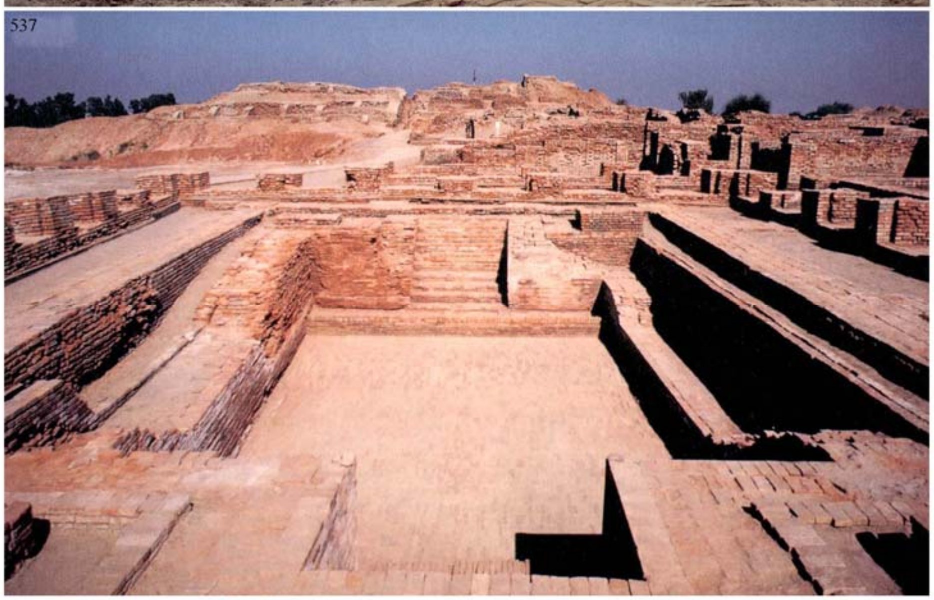
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MOHENJO-DARO HOUSING

536. The main street running north to south in the Lower City, Mohenjo-daro, 2500 BC
537. The Great Bath from the south, perhaps used for ritual bathing, Mohenjo-daro, 2500 BC.
538. Drain through wall, 2500 BC.
539. A well inside a house, 2500 BC.

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INDUS CULTURE, ROSETTE PATTERNS, POTTERY AND ORNAMENTS

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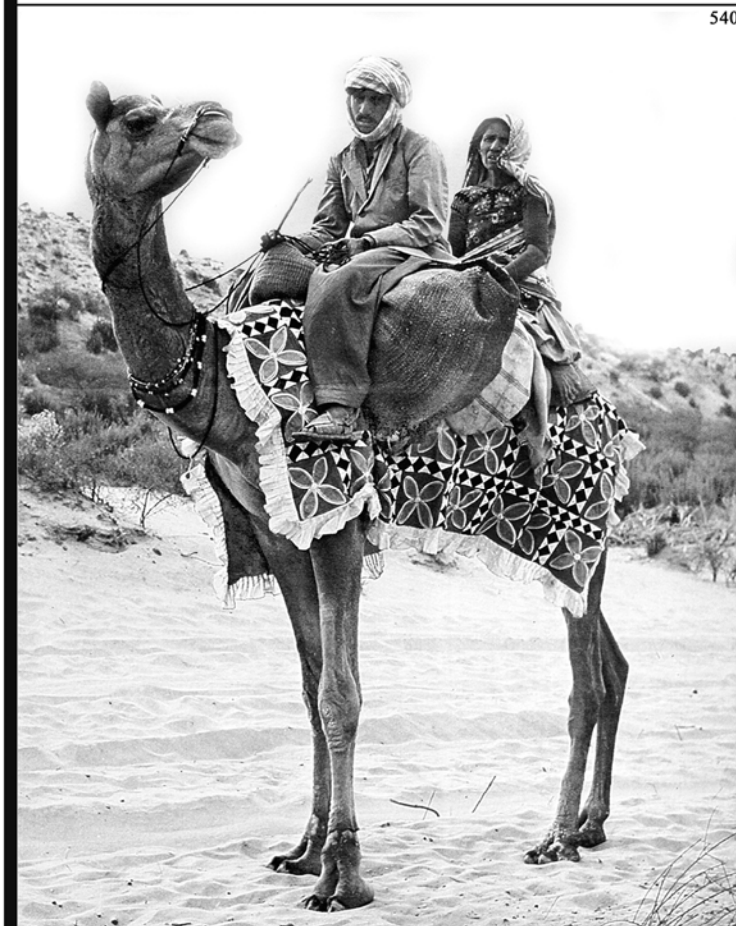

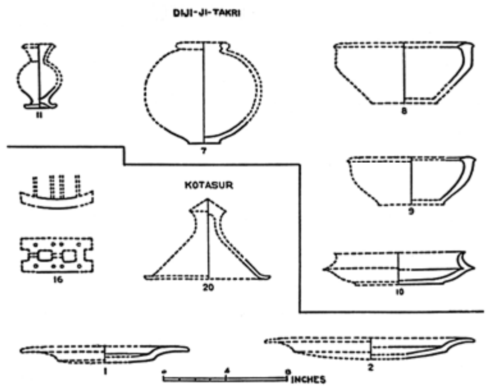

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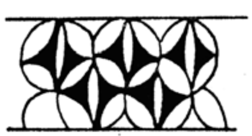
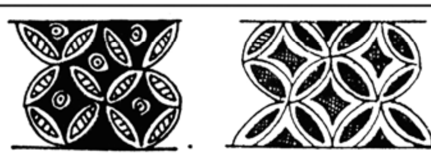
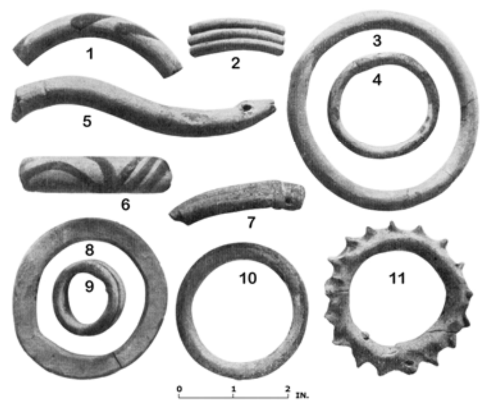
Early Indus **AMRI** **(3700-3300 BC)**	
Early Indus **KOT DIJJI** **(3300-2500 BC)**	
Mature Indus **MOHENJO DARO** **(2350-1650 BC)**	
Mature Indus **CHANHU DARO** **(Contemporary of Mohenjo Daro)**	



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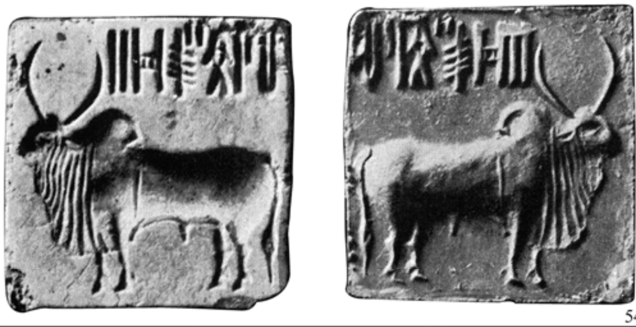
540. Design of modern camel rug is similar to rosette figures in 000.
541. Conjectural restoration of certain pottery objects.
542. Necklace or Hasli made of thick silver wire, the middle part is heavier, the opening of this necklace is from the centre with the help of a hook, 1900 AD.
543. Heavy solid silver crescent-shaped necklace, 1900 AD
544. Silver necklace, 1900 AD.
545. Rosette designs common in Indus culture are still used in 21st century rural Sindh.
546. Terracotta bangles and armlets.

Table below gives list of some crops, edible plants and herbs (medicinal plants) grown from beginning of Neolithic at Mehrgarh 7000 BC to final end of the Indus culture (Jhangar) in 900 BC

Name of plant	**7000 - 6000 BC IA**	**6000 - 5000 BC IB**	**5000 - 4500 BC II**	**4500 - 3800 BC III**	**3800 - 3400 BC IV**	**3400 - 3100 BC V**	**3100-2800 BC VI**	**2800 - 2500 BC Bronze Age VII**	**2500 - 2000 BC Harappa**	**2000-1300 BC Jhukar**	**1300-900 BC Jhangar**
Spring harvested crops											
Triticum sp. (wheat)	+	+	+								
Timonoccum (cinkorn)	+	+	+								
T.cf.durum (hard wheat)	+	+	+								
T.dicoccum (emmer)	+	+	+	+	+						
T.aestivum/compactum (bread/club wheat)		+	+	+	+	+	+	+	+	+	+
T.sphaeroccum (shot wheat)			+	+	+	+	+	+	+	+	+
Hordeum sp (barleys)											
H.spontancum (2-raw wild barley)	+	+									
H.distichum (2-row hulled barley)	+	+									
H.vulgare var. mudum (6-row naked barley)	+	+	+	+	+	+	+	+	+	+	+
H.sphaeroccum (6-row naked short barley)	+	+	+	+	+	+	+	+	+	+	+
H.vulgare (6-row hulled barley)				+	+	+	+	+	+	+	+
Avena sp (Oat)						+		+			+
Pisum sativum var. arvense (field pea)									+		
Zizyphus mauritiana or zizyphus nummularia											
Zizyphus jujube (jujube)	+	+	+	+	+	+	+	+	?	?	+
Brassica Juncca (brown mustard)									?		
Linum usitatissium (Flax/ linseed)											+
Generally fall harvested crops											
Phoenix dactylifera (date)	+	+	+							?	
Goosypium sp (cotton)				+							
Vitis Vinifera (grape)						+		+	+		+
Sorghum bicolar and Sorghum vulgare									?	+	+
Sorghum sp (sorghum)									?	+	+
Oryza Sativa (rice)									?		+
Seasum (seasmum indicum)	+	+	+								Before 1000BC
Sugarcane									?	+	+
Millet (setaria sp)											+
Setaria italica											
Setaria virids									+	+	+
Setaria verticilla											+
Setaria glauca											+
Vigna (cow pea vigna catjang) Vigna (cow pea vigna sinensis)									+		
Chenopodium album											+
Edible wild plants like:											
Euphoribia Brachiara Andropogon									+ + +	+ + +	+ + +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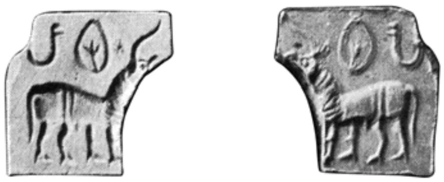
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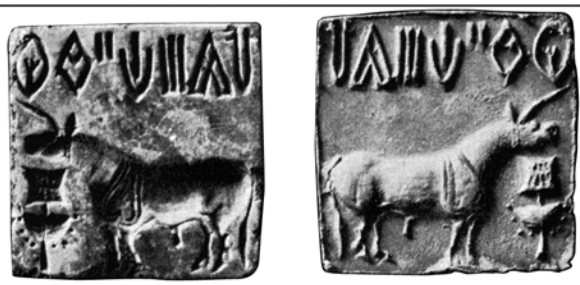
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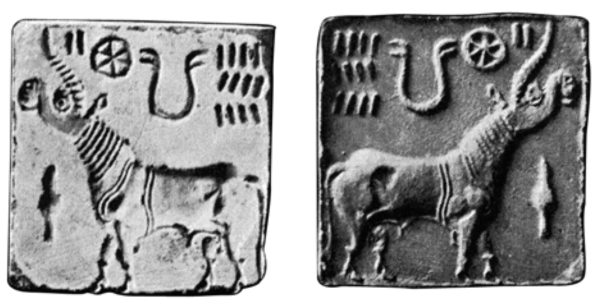
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SEALS, BRICKS AND TOYS

547,549,551,553,555 & 556. Steatite seals and their impressions with Harappa script and Indus valley animal designs, Mohenjo-daro, 2500 BC.
548. Bull with moveable head.
550. Carved bricks from the Thul.
552. Lady on a cot.
554. Animal toys, 2500 BC.

Medicinal plants of Indus culture times

Name of plant		**7000 - 6000 BC IA**	**6000-5000 BC IB**	**5000-4500 BC II**	**4500-3800 BC III**	**3800-3400 BC IV**	**3400-3100 BC V**	**3100-2800 BC VI**	**2800-2500 Bronze Age VII**	**2500-2000 BC Harappa**	**2000-1300 BC Jhu-kar**	**1300-900 BC Jhangar**
Scientific Name	**Family Name**											
Abelmoschus	Malvacae							+	+	+	+	+
Acacia	Mimosoideae							+	+	+	+	+
Boerhavia	Nyctagina-eae							+	+	+	+	+
Borreria	Compositae							+	+	+	+	+
Convolvulus	Convolvulac-eae							+	+	+	+	+
Carchorus	Sterculiaeae							+	+	+	+	+
Cucumis	Cucurbi-taceae							+	+	+	+	+
Cymbopogon	Poaceae or Gramineae							+	+	+	+	+
Cyperus	Cyperaceae							+	+	+	+	+
Digera	Amaran-taceae							+	+	+	+	+
Dious	Urticaceae							+	+	+	+	+
Glossocardia	Compositae							+	+	+	+	+
Goniogyna	Papiliona-ceae							+	+	+	+	+
Indigofera	Papiliona-ceae							+	+	+	+	+
Ipomoea	Convolvu-laceae							+	+	+	+	+
Lens	Fabaceae or Leguminosae							+	+	+	+	+
Melochia	Sterculiaceae							+	+	+	+	+
Paspalum	Poaceae or Gramineae							+	+	+	+	+
Phyllanthus	Euphorbia-cidae							+	+	+	+	+
Polygala	Polygalaceae							+	+	+	+	+
Polygonum	Polygona-ceae							+	+	+	+	+
Rorippa	Cruciferae							+	+	+	+	+
Sida	Malvastrum							+	+	+	+	+
Stellaria	Caryophyl-laceae							+	+	+	+	+
Tragus	Poaceae or Gramineae							+	+	+	+	+
Trianthema	Aizoaceae							+	+	+	+	+
Zizyphus	Rhamnaceae							+	+	+	+	+

Introduction of Karez in Balochistan is attributed to Achaemenians. The figure below shows principle of Karez. Present writer found that Karez water used during the year can be 42%. Karezes were dried in 1960 to 1980 by putting deep dug wells below the level of karez water galleries and pumping them. A few are now maintained in Balochistan as an archaeological curiosity at exorbitant costs.

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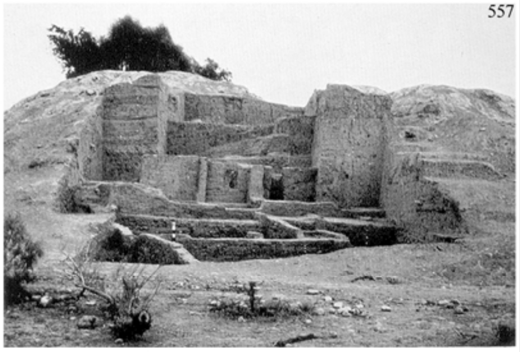

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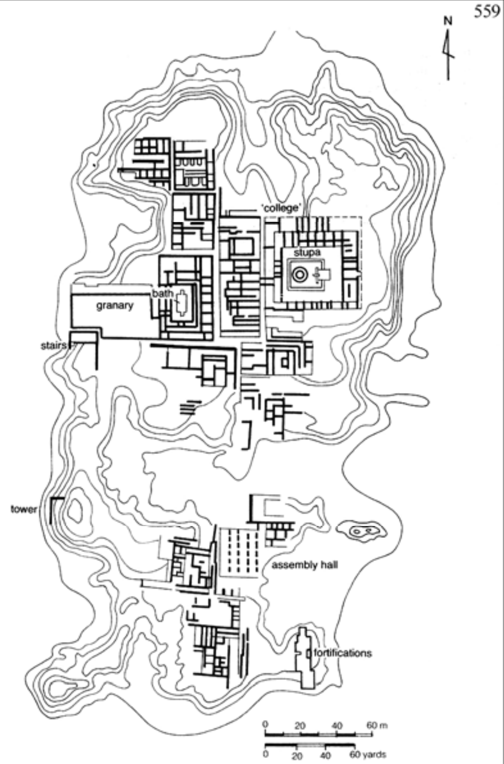

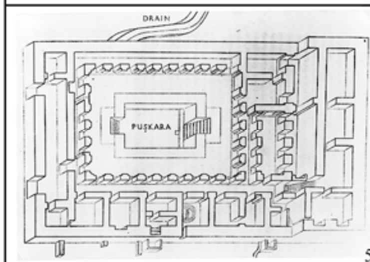

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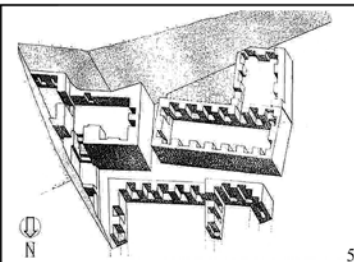

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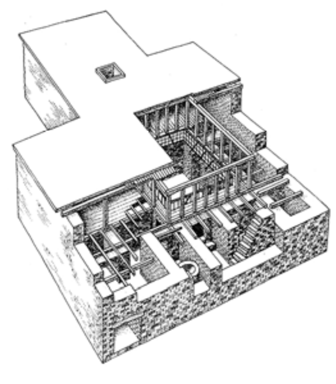

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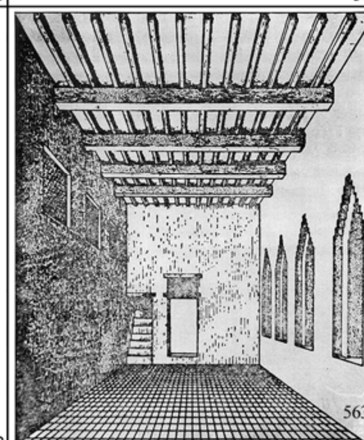

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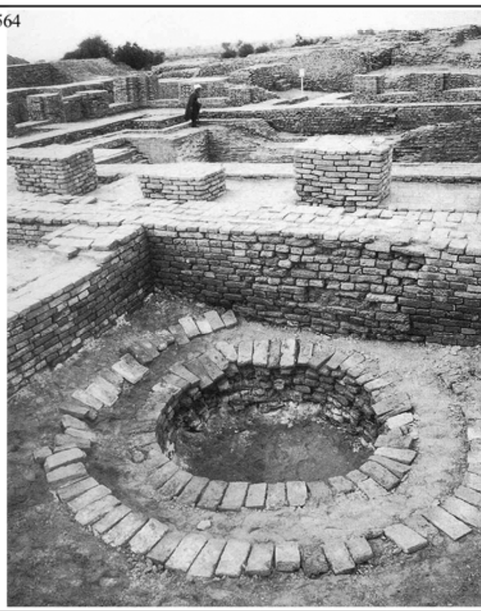

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STRUCTURES AND PLANS

557. Excavation in "Amri" buildings in mound A.
558. Mohenjo-daro rich residential area.
559. A circular well-note the wedge-shaped bricks, 2500 BC.
560. The Great Bath, Mohenjo-daro, 2200-2100 BC (plan reconstructed).
561. Isometric projection of brick house showing characteristic wall niches, Pirak, period IIIB, 1800 BC.
562. Private dwelling house, Mohenjo-daro, 2350-2000 BC.
563. Interior of a typical house at Mohenjo-daro (reconstructed); the brick tiled floor, wooden beams and rafter on the roof, Mohenjo-daro, 2300-1700 BC, after Marshall, 1931
564. Well structure in the Great Bath, Mohenjo-daro, 2500 BC.
565. Rectangular buff stone depicting various jewelry items of necklaces, earrings, anklets, etc., 1650 AD.
566. Rectangular buff stone carved in relief with half and complete lotus motifs within multi-cusped arches, the centre of the stone is carved with chess pattern, the entire pattern is rendered within single and double chain-border, 1650 AD. 000

CHAPTER 10

CAUSES OF DECLINE OF THE INDUS VALLEY CIVILISATION; 1,650 - 900 BC

ARIDITY AND FALL OF INDUS CIVILISATION (2000 - 900 BC)

The climate started changing to aridity around 2,000 BC and around 1,800 BC it become bad enough to bring an end to Harappa in 1,750 BC and Mohenjo Daro in 1,650 BC. The Mohenjo Darians resorted to pastoralism and as would normally happen to survive they put more animals to graze in the whole Sindh than its scanty vegetation could support during aridity leading to further deterioration of land (means of production) and society. This is commonly called Jhukar culture. The climate further changed to hyper-aridity around 1,300 BC and the culture further disintegrated. This lasted up to 900 BC and is known as Jhangar culture.

HYDROLOGICAL CHANGES IN THE REGIME OF THE RIVER AND DECAY OF THE INDUS CIVILISATION

The following are major hydrological changes:

a) The Indus must have been flowing near Mohenjo Daro since its establishment and probably changed course either to west or to eastwards by good 10 to 15 miles or so thus making it difficult to shift the population to new area.

b) Since in the Indus plains the lowest point of ground lie along its western and eastern boundaries making the plains convex and most of the Indus cities were in the centre of the plains i.e., on the ridge such swing in the river bed will simply make it impossible for these cities to get water from the Indus.

c) It seems that even the western branch of the River Indus, which was already passing through Sindh Hollow and the river probably had recently shifted to it. It became impossible for Mohenjo Daro, Jhukar, Chanhujo Daro and other cities to get water from this source.

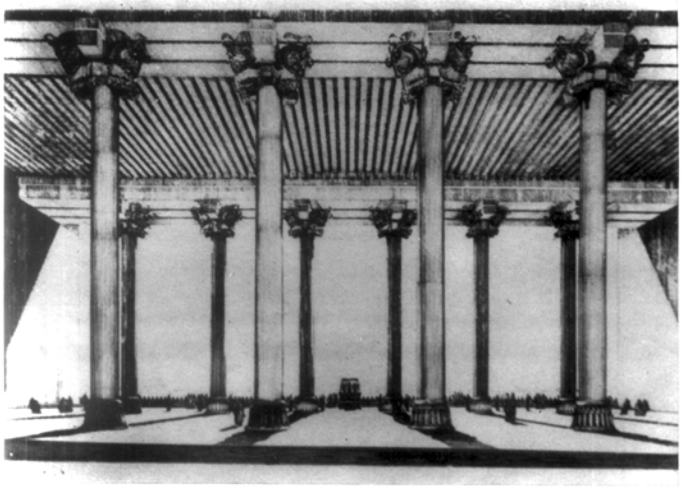
d) In case of the Sarsuiti sites there was reduction in water of that river in the beginning of second millennium BC due to titanic movement and decrease in rain fall after 2,000 BC.

These changes destroyed the water management and Sailabi cultivation system in the Indus plains totally and thereby the civilisation declined and decayed. The explanation of Wheeler (1959) that it was growing population combined with wearing out of landscape is not acceptable. Archaeological excavations in Mesopotamia and the Indus valley both are over extensive areas and done intensively in some important centres that estimation of population of these towns is no longer mere guess work. Mohenjo Daro is estimated to have the same population as Shikarpur in 1941 i.e. 30,000 people, as estimated by Lambrick (1973), but the late Walter A. Fairservis Jr., a professional archaeologist and excavator, puts his conservative estimate at 41,500 people. He has also given further data and the following interesting estimates for area around Mohenjo Daro, which catered for its needs:

Wheat	22,715.0 acres
Fodder	30,97.5 acres
Cattle	25,812.5
Bullocks (draft)	3,226.5
Milk cows	2,610.0
Cattle - young and aged cattle (non-milk and non-draft)	2,918.3
Total cattle	8,754.8
Grazing forage area	3,278.5 acres

This simply shows the extent of population Sindh could support.

Lambrick estimated Indus population at 500,000 to 600,000, but this is too conservative a figure when rudimentary irrigation was more than 1000 year old in Sindh. Since pressure of population caused migration to Sarsuiti valley in Bikanir and



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ACHAEMENIAN MONUMENTS AND SEALS

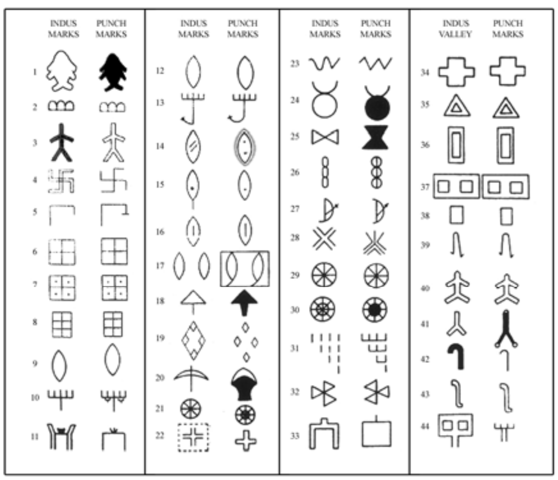
567. The hall of audience at Persepolis, which could accommodate 10,000 people.
568. Impression of an Achaemenid cylinder seal: the royal hero standing on sphinxes raises lions in a gesture of triumph.
569. Winged bull, from the gate way of tomb of Xexzes at Bistun.
570. Impression of an Achaemenid cylinder seal inscribed with the name of Darius, found at Thebes
571. Naqsh-i-Rustam: Rock of Achaemenian Kings and fore alter.

Bahawalpur and also to Kutch, Kathiawar and northern Gujarat a figure of one million would also be a conservative estimate for the whole Sindh. Most of the authors forgot that with rain fall two-and-half times the present Thar and Kohistan would have supported two to three times the present population.

FOREIGN TRADE

It is generally believed that Sindh lost contacts with outside world, but presence of a pot containing cloves in Syria dating back to 1,760–300 BC shows that contacts existed not only with Mesopotamia but also with Indonesia, Singapore and etc., via the Indian ports during Jhukar times.

During this period regular canal irrigation from the Indus was evolved. Rice has been found at Pirak, 10 miles south of Sibi. Millet first appeared at Jemdt Nasr (Mesopotamia) around 3,000 BC and in spite of trade with Sindh its presence in Sindh is not proved. Sorghum of tropical Africa (southern Saharan) travelled to south India via Arabia before reaching Sindh is another archaeological mystery. Rice was grown in south and east India and even in UP during Mohenjo Daro times probably on rain water and in absence of irrigation could not be cultivated in Sindh. It had reached China from India in 2,000 BC.



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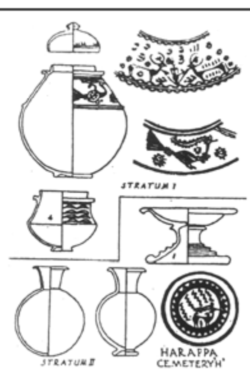

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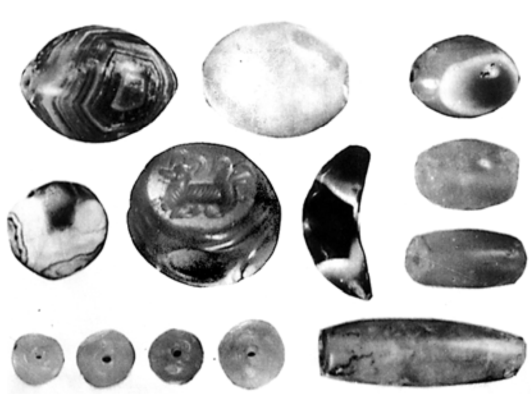

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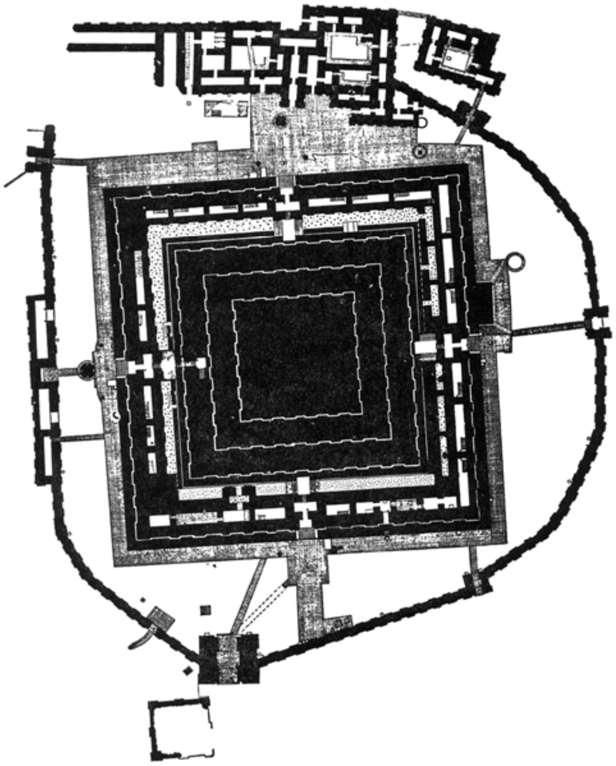
INDUS SYMBOLS, WARES AND KAREZES

572. Comparative table of symbol on Indus valley seals and punch marked coins, Marshall 1931.
573. Objects found from Jhukkar.
574. Jhangar ware produced during the late declining Indus culture, 1100-900 BC.
575. Jhukar ware produced during early period of declining Indus culture,1650-1300 BC.
576. Cemetery H cultural ware of declining Indus culture, 1750-1700 BC
577. Semi-precious stones, beads and pendants from Brahmanabad-Mansura.



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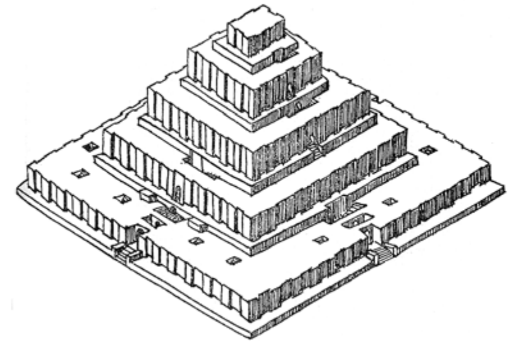

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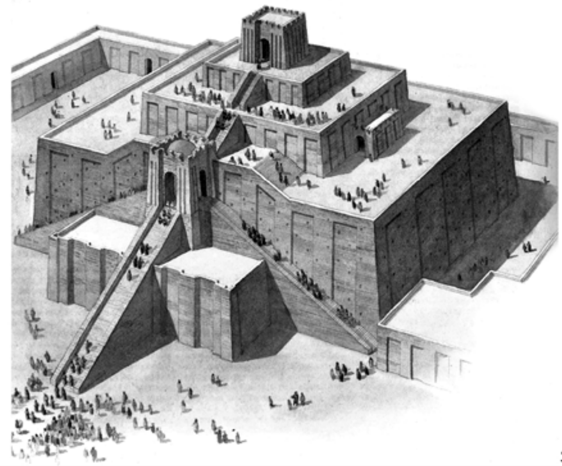

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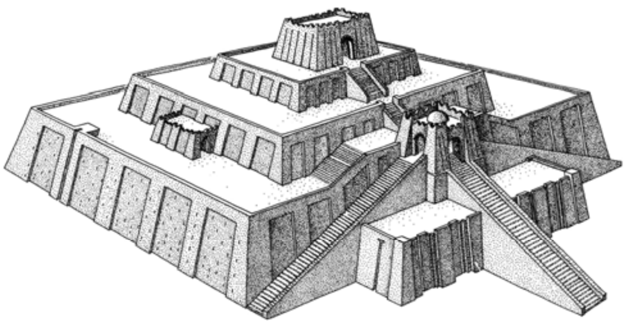

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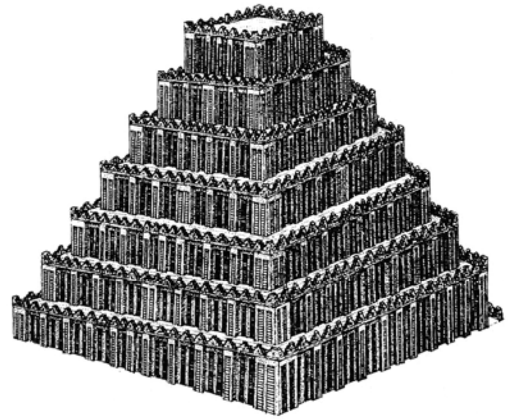

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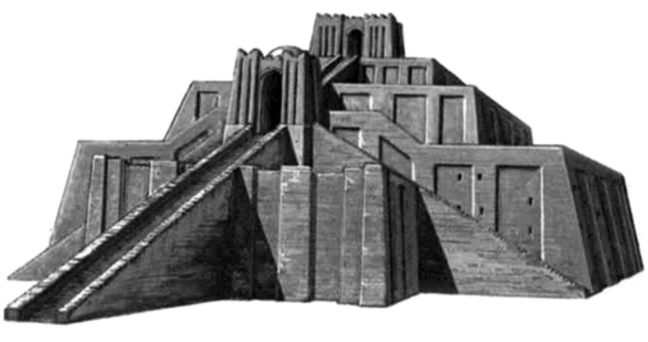

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ZIGGURAT

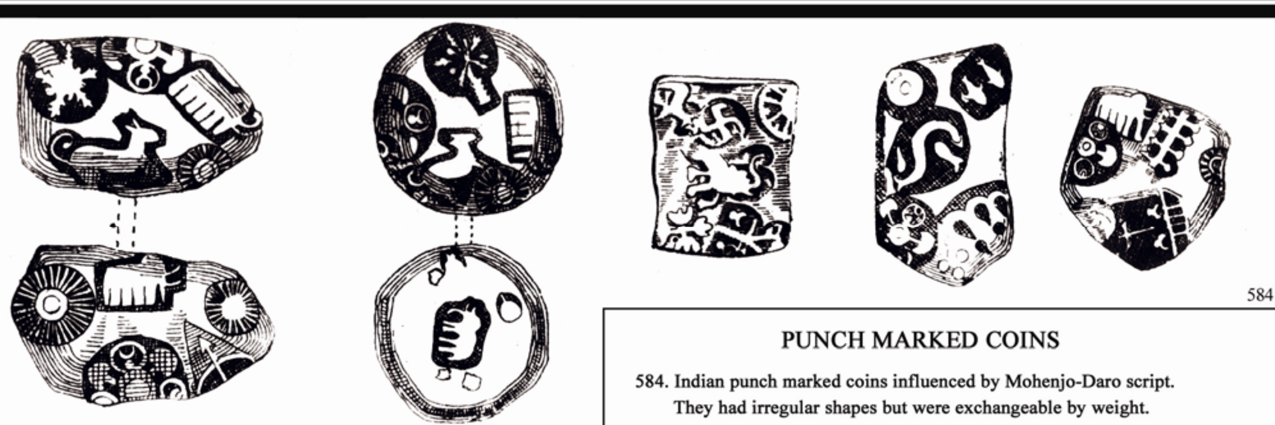
578. Plan of the ziggurat of Tchoga Zanbil.
579. Reconstruction of the ziggurat of Tchoga Zanbil.
580. Ziggurat, 500 BC.
581. Jhangar ware produced during the late declining Indus culture, 100-900 BC.
582. Ziggurat, 1000-500 BC.
583. Ziggurat, 2500 BC.

CHAPTER 11

IRRIGATION; 700 - 519 BC

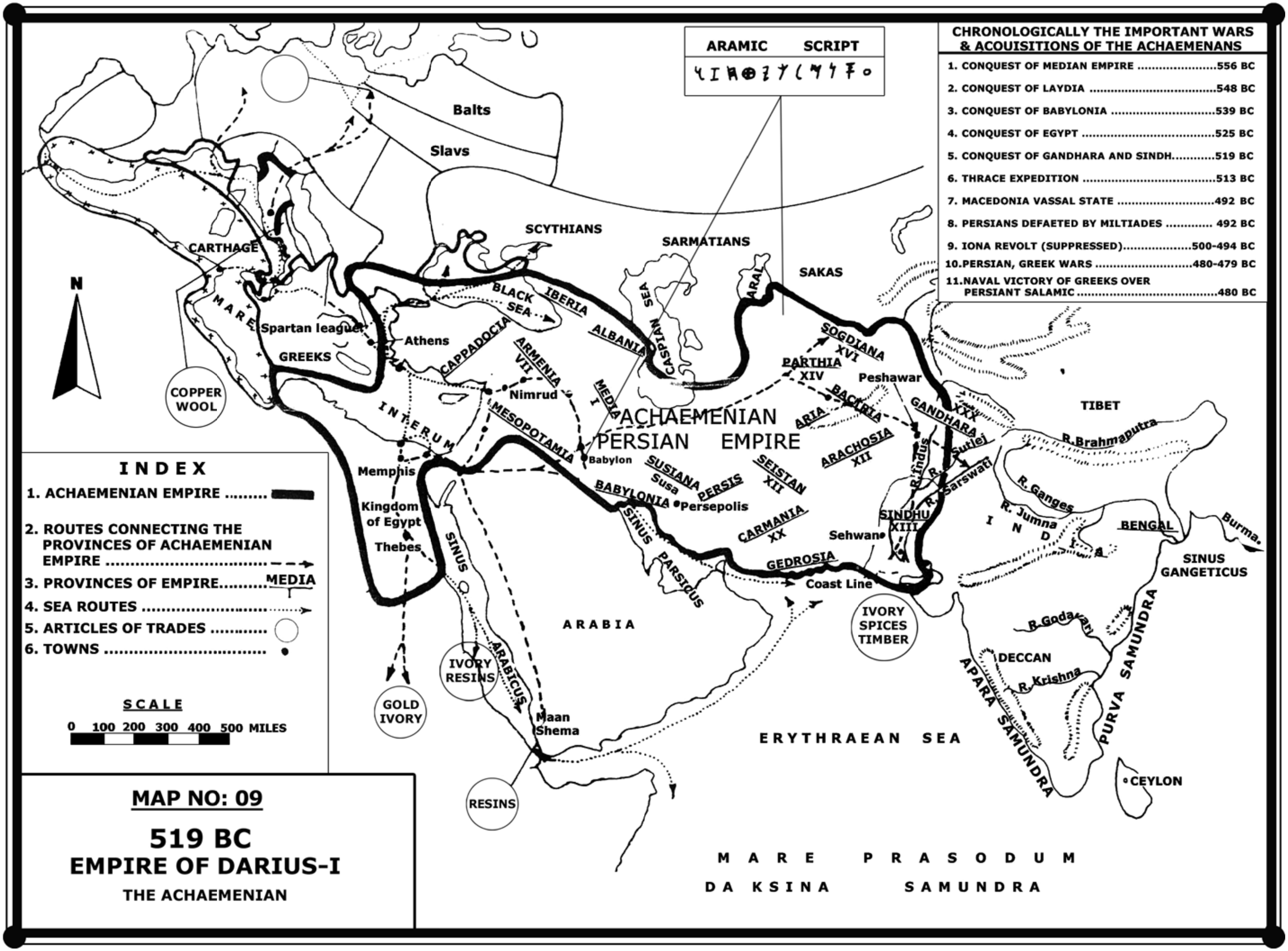
Around 600 BC we hear of sixteen major states of Vedic tribes in the northern parts of South Asia. These sixteen states do not include the present Deccan state, Bangladesh, Sindh, Gujarat and Kathiawar. Sindh was called Sindhu and probably the present Bahawalpur, Sukkur, Khairpur and Nawabshah were called Sauvira then. By this time the so called Rig Vedic Aryans, who originally were pastoral nomads, had settled on agricultural lands in the Punjab. They must have taken to summer irrigation, which after introduction of summer crops like rice, sorghum and millets around 1,900 - 1,600 BC was already well developed and must have made serious efforts to bring more area under canal irrigation instead of only relying on Sailabi cultivation, which must have reduced considerably due to low supplies of water in Indus caused by aridity. It had decayed under Cemetery-H, and Jhukar and Jhangar people must have been improved by then. The Aryan ascendancy since 800 BC could only be due to irrigated agriculture. The evolution of Kharoshthi script from early Greek and Hebrew shows expanding trade with south-east Mediterranean countries and this trade in turn could only be an outcome of agricultural surplus helping in growth of urban life as well as artisan labour. The agricultural surplus also activated religious and philosophical speculations resulting into writing of Brahmas, early Upanishads and Sutras and also the rise of Buddhism and Jainism. It could fairly be concluded that Vedic tribes helped establishment of irrigated agriculture in the South Asia, which increased the population and the latter in turn reclaimed more and more lands by irrigation. Ultimate result was reduction in pasturelands and consequently reduction in production of meat. At this stage Brahmans were compelled to ban use of meat for the whole populace, but themselves. Resentment against this decree of Brahmanism helped expansion of Buddhism under Buddha (566-486 BC) who forbade use of meat for everybody. The beginning of Buddhism would be the decline of irrigated agriculture in the South Asia, Sindh included, and reaching large population since the downfall of mature Indus culture, but land not being able to support the numbers.

The acceptance of Jainism (under Vardhmand Janatapura (599-527 BC), whose teachings were similar to Buddhism, in Sindh much before introduction of Buddhism shows that conditions for opposing Brahmanism in Sindh were ripe much earlier than elsewhere. It could have been due to extended irrigation and increase in population resulting into reduction in pasture and thereby meat. During this period teak wood from Bihar was brought by the Ganga River to Jammuna and from the latter by camels to the Sutlej to be floated down the Indus to sea ports for shipment to Mesopotamia. Among the non-agriculture products exported were; two humped camels, ivory and elephants.



PUNCH MARKED COINS

584. Indian punch marked coins influenced by Mohenjo-Daro script. They had irregular shapes but were exchangeable by weight.



MAP NO: 09
519 BC
EMPIRE OF DARIUS-I
THE ACHAEMENIAN
CHRONOLOGICALLY THE IMPORTANT WARS & ACOUISITIONS OF THE ACHAEMENANS
1. CONQUEST OF MEDIAN EMPIRE ....556 BC
2. CONQUEST OF LAYDIA ....548 BC
3. CONQUEST OF BABYLONIA ....539 BC
4. CONQUEST OF EGYPT ....525 BC
5. CONQUEST OF GANDHARA AND SINDH....................519 BC
6. THRACE EXPEDITION ....513 BC
7. MACEDONIA VASSAL STATE ....492 BC
8. PERSIANS DEFAETED BY MILTIADES ....492 BC
9. IONA REVOLT (SUPPRESSED)....................500-494 BC
10.PERSIAN, GREEK WARS ....480-479 BC
11.NAVAL VICTORY OF GREEKS OVER PERSIANT SALAMIC....................480 BC
ARAMIC SCRIPT
INDEX
1. ACHAEMENIAN EMPIRE ....
2. ROUTES CONNECTING THE PROVINCES OF ACHAEMENIAN EMPIRE ....
3. PROVINCES OF EMPIRE.......... MEDIA
4. SEA ROUTES ....
5. ARTICLES OF TRADES ....
6. TOWNS ....
SCALE
0 100 200 300 400 500 MILES
N
Balts
Slavs
SCYTHIANS
SARMATIANS
SAKAS
CARTHAGE
MARE
Spartan league
GREEKS
Athens
COPPER WOOL
CAPPADOCIA
ARMENIA VII
Nimrud
MEDIA I
BLACK SEA
IBERIA
ALBANIA
CASPIAN SEA
ARAL
INTERUM
MESOPOTAMIA
Babylon
ACHAEMENIAN PERSIAN EMPIRE
SUSIANA
Susa
PERSIS
Persepolis
BABYLONIA
SEISTAN XII
ARACHOSIA XII
ARIA
BACTRIA
PARTHIA XIV
SOGDIANA XVI
Peshawar
GANDHARA XXX
CARMANIA XX
GEDROSIA
SINDHU XIII
Sehwan
Coast Line
R. Indus
R. Sutlej
R. Sarswati
Memphis
Kingdom of Egypt
Thebes
SINUS
SINUS PARSICUS
ARABIA
ARABICUS
IVORY RESINS
GOLD IVORY
Maan Shema
RESINS
IVORY SPICES TIMBER
ERYTHRAEAN SEA
MARE PRASODUM
DA KSINA SAMUNDRA
TIBET
R. Brahmaputra
R. Ganges
R. Jumna
INDIA
BENGAL
Burma.
SINUS GANGETICUS
R. Godavari
DECCAN
R. Krishna
APARA SAMUNDRA
PURVA SAMUNDRA
CEYLON

CHAPTER 12

ACHAEMENIANS AND IRRIGATION IN SINDH; 519 - 400 BC

In the middle of sixth century BC rose the world's first great empire under Achaemenians which by 519 BC extended from present Pakistan in the east, to Nile valley in the west, to Greece in the north and to the Arabian Sea in the south. The various rulers of this dynasty were:

Name	Period
Cyrus-I	640 – 600 BC
Combyses-I	600 – 559 BC
Cyrus-II	559 – 530 BC
Combyses-II	530 – 522 BC
Bardita	522 – BC
Darius-I	522 – 486 BC
Xerxes	486 – 465/64 BC (murdered by his uncle)
Ataxerxes-I	465 – 425 BC (Assassinated due to palace intrigues)
Darius-II	426 – 404 BC
Ataxerxes-II	406 – 359 BC
Ataxerxes-III	359 – 337/38 BC
Arses	337/38 – 336 BC
Darius-III	336 – 330 BC

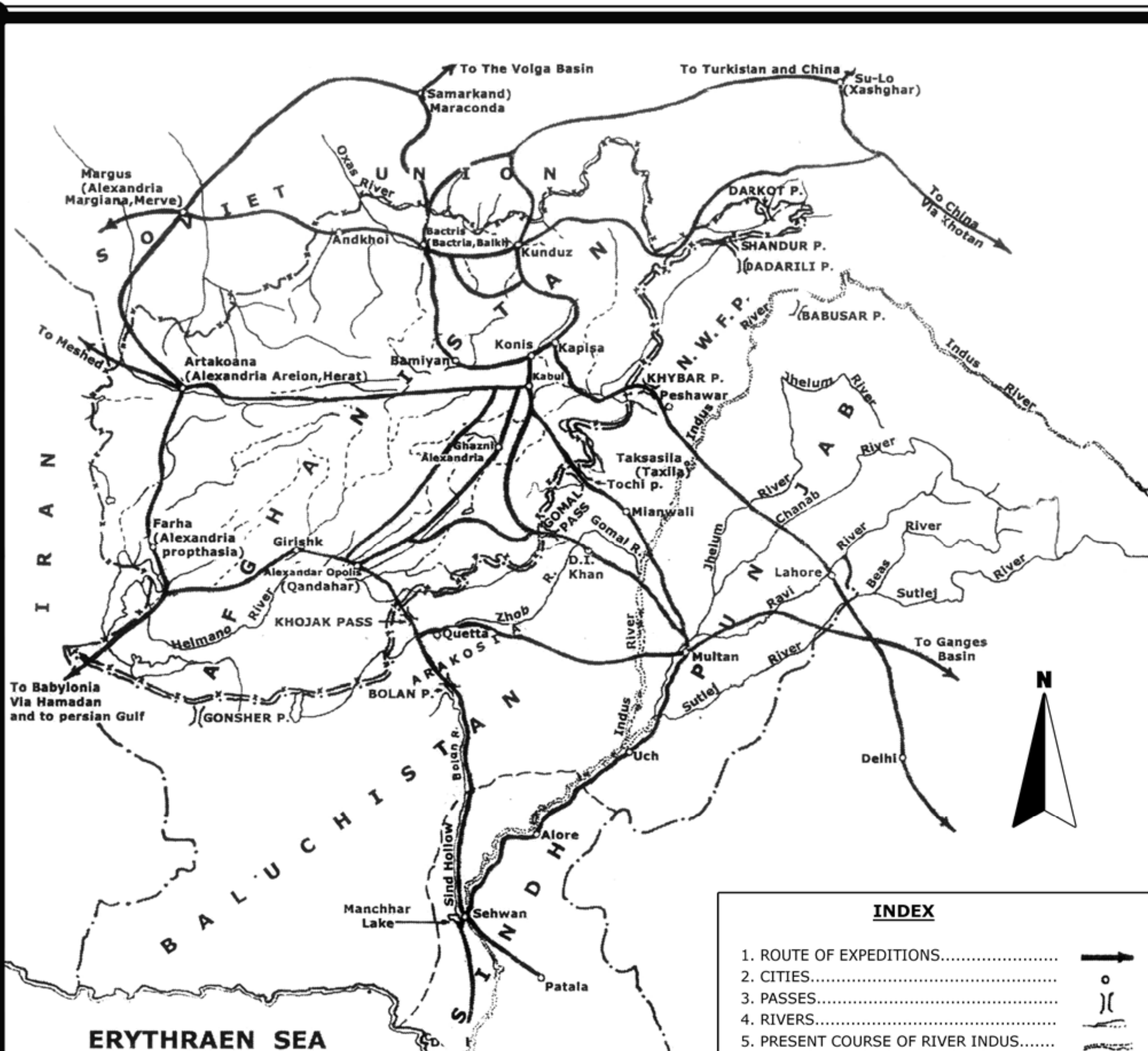
Sindh was conquered by Darius-I in 519 BC. The empire was divided into twenty two satrapies (provinces) each headed by a member of royal family as governor. The present Pakistan was divided into three provinces: Gandhara (Khyber Pukhtoonkhawh and the northern Punjab); Hindu or Sindhu (Multan to Sindh coast - the twentieth satrapy and Kutch) and Gedrosia (present Balochistan and adjoining parts of Iran). They probably did not control Thar, Wara and Cholistan as that was a free territory of nomadic pastorals. Under Ataxerxes-I empire started weakening and Sindh may have become independent by 450 BC or latest by 400 BC when Egypt also became independent.

Achaemenians laid principles to govern an empire; strict administrative control, periodic inspection without any notice, Imperial Secretary or listener (ears of king) attached to the governors' headquarters but directly reporting to the king, independent army directly responsible to the king, espionage system, use of introduction of bacon signals and network of roads. All this gave Achaemenianss rigid control over the provinces and people. Offering one's daughter to a noble or royalty was considered loyalty to the king. It was introduced in India by the Delhi Sultans and Mughals who introduced strict seclusion of women – not by Arabs, as generally believed.

The major crops of period were; rice, wheat, cotton, sugarcane, oil seeds, millet, sorghum, pulses, mango, ber, dates and some varieties of citrus. Surplus was invariably exported. Indigo and timber were industrial commodities of the era. Cane sugar was for the first time seen in the Punjab and Sindh by Europeans under Alexander in 326-24 BC. It was exported to lands one time conquered by the Achaemenians as medicine until 8^{th} century AD.

The Indus was an important water way for trade too. It drained waters of much less territories than goods it carried to its ports near the mouth from the whole of north parts of South Asia inclusive of parts of Tibet, Sinkiang and even the Central Asia. As early as the third dynasty of Ur wood was exported from country of Meluhha (Sindh) to Mesopotamia. This must have come from northern district via the Indus.

Sindh exported cotton, grains (wheat, rice, sorghum, millets, pulses and oil seeds), indigo, madder, ivory, spices, hides, timber and sugar. Imports were; resins, copper, silver, gold and wool. Land was major source of taxation in Sindh. Taxes were fixed and so were the amounts each satrapy was to collect and pay to the central treasury. Burden of taxes was very heavy as in terms of gold Sindh paid 360 talents of gold. Taxes were imposed on Sindhu (Hindu) satrapy i.e. from Multan to Kutch. In



MAP NO: 10

519 BC - 1524 AD

ROUTES OF TRADE AND INVASION OF SINDH

ACHAEMENIANS, MACEDONIANS, BACTRIANS, SCYTHIANS, PARTHIANS, KUSHANS, SASSANIANS AND ARGHOONS. FROM CENTRAL ASIA THROUGH AFGHANISTAN.

INDEX

1. ROUTE OF EXPEDITIONS......................
2. CITIES..
3. PASSES...
4. RIVERS...
5. PRESENT COURSE OF RIVER INDUS.......
6. BOUNDARY OF PAKISTAN......................
7. BOUNDARY OF AFGHANISTAN...............
8. BOUNDARY OF PAKISTAN AND AFGHANSITAN...................................

SCALE

0 100 200 300 MILES

NOTE:-

THE EXCEPTION TO THIS WERE THE ARABS, WHO INVADED VIA MAKRAN COAST AND THE SEA. THE DELHI RULERS FOLLOWED DELHI-MULTAN ROUTES TO SINDH. SINDH COULD ONLY BE INVADED FROM DELHI, IF THOSE RULERS HAD FULL CONTROL OVER MULTAN AND BAHAWALPUR DIVISIONS. SUCH INVASIONS RESULTED ONLY IN BRIEF CONTROL OVER SINDH. TO COMBAT THIS RAIS AND BRAHMANS CAPTURED MULTAN. ARABS FOLLOWED THE EXAMPLE.

MAHMUD OF GHAZNI AND MUHAMMAD TUGHLAQ INVADED SINDH VIA RANN OF KUTCH, AS THEY HAD NO OTHER ROUTES AVAILABLE.

UNDER SEVERE DROUGHT CONDITIONS BETWEEN 600 - 450 AD, ACHAEMENIANS BUILT THE WORLD'S FIRST LARGE EMPIRE, WHICH INCLUDED THREE ANCIENT CIVILIZATIONS OF THE NILE, THE EUPHRATES AND THE INDUS. THESE THREE AREAS PRODUCED SURPLUS GRAINS, WHICH COULD BE FED TO THE PEOPLE OF VAST CENTRAL ASIAN ARID AREAS. ACHAEMENIANS AND THEIR SUCCESSORS OF THE CENTRAL ASIA NAMELY BACTRIAN GREEKS, SCYTHIANS, PARTHIANS AND KUSHANS ENCOURAGED AGRICULTURE PRODUCTION, BUT IMPOSED HEAVY TAXES. THEIR EMPIRE COLLAPSED ON ACCOUNT OF BURDEN OF TAXES IN ABOUT A CENTURY. HOWEVER THEY GAVE THE WORLD THE FIRST GREAT ADMINISTRATIVE SETUP, WHICH BECAME EXAMPLE FOR OTHERS TO EXPERIMENT UPON.

addition to this all expenses of local administration and army were also paid. Sindh was also to provide annually 30 tons of silver, supplies for army and court for four months a year – fodder for 800 stallions and 1600 mares of local governor, income from four large villages for up keep of governor's dogs and finally 500 boys a year to be converted to eunuchs for harems of governor and royal families. Under Darius-I the use of gold and silver money as means of exchange became general and it made commercial relations easier.

Darius-I entrusted his admiral Skylax to navigate from Peshawar down the Indus to the sea and from there via Balochistan coast Bahrain, coast of Arabian Peninsula and the Red Sea to the east coast of Egypt. The Nile in turn was to be connected to the Red Sea by renovating the abandoned Nacho's canal. This was to connect Sindh with Egypt and both countries with the Persian Gulf for building up the trade of all the satrapies. Sindh paid maximum amount of taxes to the Achaemenian Empire showing the extent of irrigation already achieved before the conquest by Darius-I.

Achaemenians contributed to agriculture by introducing in Sindh plough with a seed drill attachment originally developed by Babylonians. They introduced Karezes in Balochistan. Use of writing, which is necessitated by official bureaucracy for maintaining the accounts, is an outcome of extensive agriculture calling for these records. Kharoshthi had already developed in Gandhara province in the sixth century. Brahmi alphabet appeared in 483 BC. Sindh, which had gone illiterate after fall of Mohenjo Daro in 1650 BC, was to have a script again like the Indus script. This was triumph of agriculture at its climax. Sindh managed to become independent of Achaemenian rule between 450-400 BC and was ruled by a number of principalities as Alexander was to see in 325/324 BC. They seem to have managed irrigational system well as Macedonians encountered a fertile and prosperous Sindh.

As discussed before in the Indo-Gangetic plains maintenance of irrigational woks needed small despots on each watercourse and somewhat bigger despots and kings who would maintain canals from which watercourses took off. A king would control almost all canals within a practical irrigational unit. The various kingdoms of Sindh, which Alexander saw perfectly, fit in this system of irrigational units. Since the river changed the course periodically irrigational units varied and so the boundaries of the kingdoms. A look at map No.( ) 325/24 BC will clearly show that:

1. Area on the east of River Indus but above the Kot Dijji hills (Rohri and Ghotki subdivision) would form an irrigational unit.
2. Area between the River Indus and its western branch forming an island could be another irrigational unit.
3. Area west of the western branch of Indus would form a third irrigational unit.
4. The two major branches of Indus; the Puran and Kalri would make two other irrigational units.

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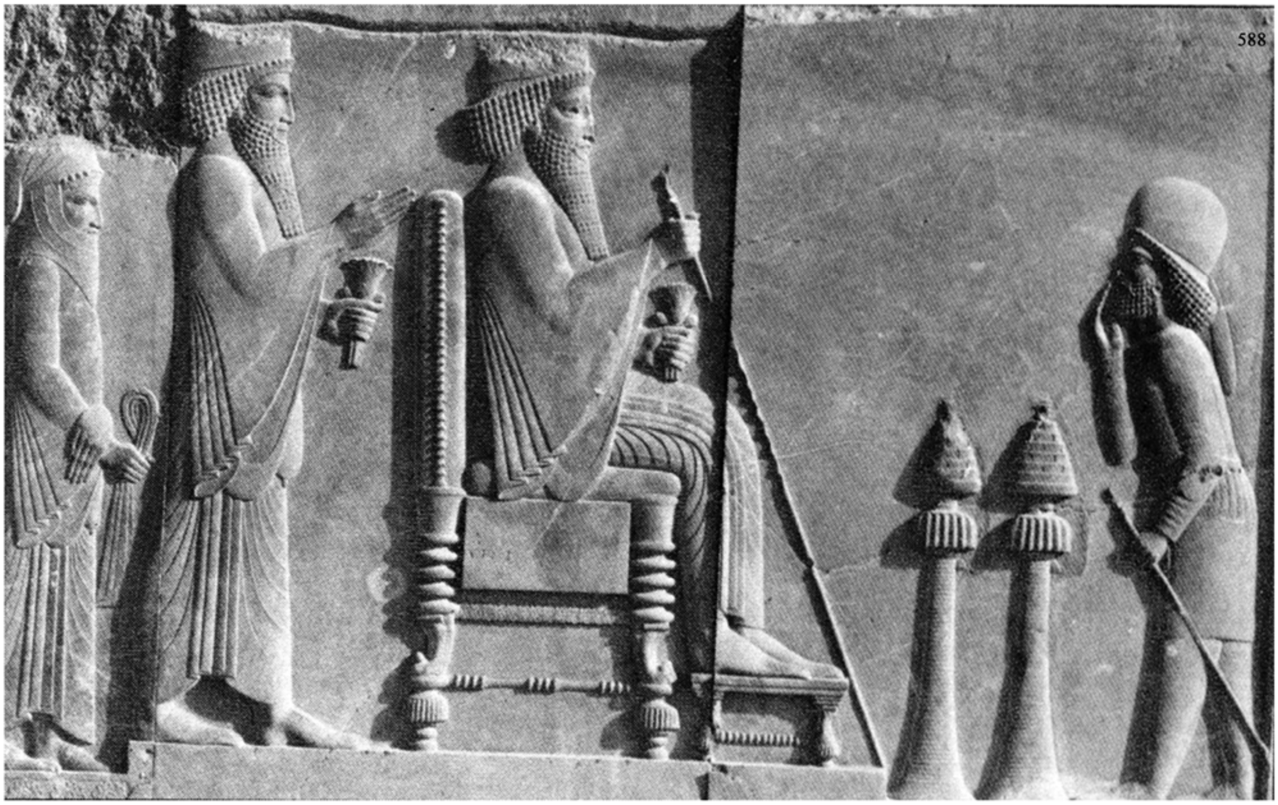
ARAMAIC, KHAROSHTI SCRIPT AND PUNCH MARKED COINS

585. Aramaic inscription of Asoka, Pul-i-Darunta, Afghanistan.
586. Indian punch marked coins influenced by Mohenjo-Daro script.
587. Kharosthi inscription of Menander (175 BC), Bajaur, Khyber-Pukhtunkhwa. Kharosthi may have been common in Sindh.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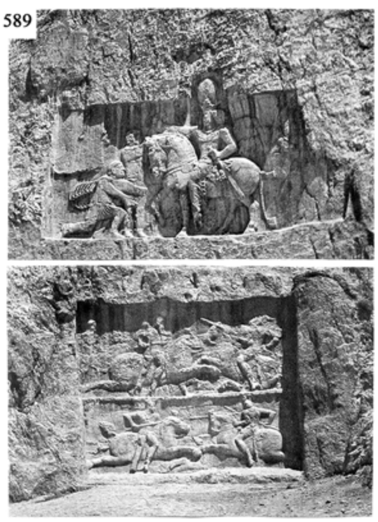
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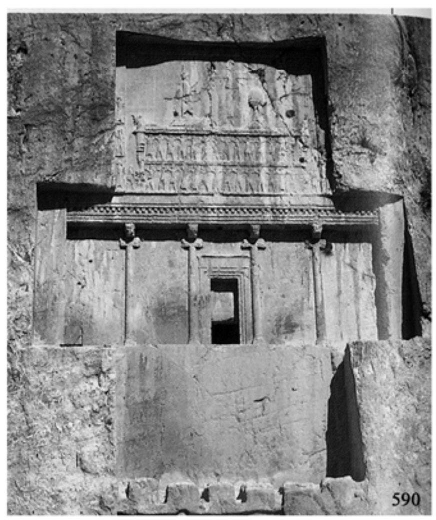
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ACHAEMENIAN COURT AND MONUMENTS

588. King Darius shown at his royal palace at Persepolis receiving a high Median official, 500 BC.
589. (above) Sassanian rock relief at Naqsh-i-Rustem with a representation of the triumph of Shapur-I (241-272 AD) over two Roman emperors. (below) Sassanian rock relief at Naqsh-i-Rustem depicting an equestrian battle of Bahram-II (276-293 AD).
590. Rock-cut tomb of Darius-I, Persepolis, Iran.

Persian eclecticism. The Persians built in a bold, eclectic style using the architectural traditions of their defeated subjects: columned halls from Media in western Iran, reliefs from Mesopotamia, Greek stone-working techniques, Egyptian doorways and rock-cut tombs from mountainous Urartu (on the borders of modern Turkey and Armenia). The rock-cut tomb of Persian ruler Darius-I (522-486 BC) recreates a façade of the palace at Persian capital Persepolis.

591. Head of Darius from the relief at Bisutun.
592. Ancient dress: Stone reliefs on a ceremonial stairway at Persepolis in Iran show the ecological diversity of the vast Persian Empire (550-331 BC) by the differences in clothing of the peoples depicted. Those from the hot plains wear loose, full-length robes, while the horsemen of the cold mountains wear trousers, tunics and cloaks. (detail, stone relief, Persepolis, Iran, 519 BC.

CHAPTER 13

ALEXANDER'S CONQUEST OF SINDH AND IRRIGATION 326 - 325 BC

Born in 356 BC Alexander after death of his father in 336 BC became Mecedonian king. His father had developed the invincible phalanx, which was further improved by Alexander. Phalanx consisted of army trained to attack and defend simultaneously. The armoured soldier was covered with steel from head to tow and shield of size of man protected him. When attacked by a cavalry the soldiers lined up forming a wall of shields and as horseman came nearby they quickly moved behind each other allowing the cavaliers to pass through and as he did they turned back to hit him and horse at the back with a long lance killing him instantly. Thus, phalanx was the most superior weapon produced by combination of armoured solider, shield and lance.

Two years after his coronation he defeated the Achaemenian army in the battle of Granicus. In 333 BC he defeated Darius-III who escaped leaving behind his family, which was well treated by Alexander. In 332-31 BC he occupied Egypt. In 331 BC he finally defeated Darius-III in the battle of Gaugamela near Ancient Nineveh. Darius was killed by his own men. Alexander then advanced on Babylon. Next was invasion, fall and burning of Susa where he got vast treasures of the Achaemenians collected over two and half centuries. In 327 BC he married Roxanne daughter of a Bactrian Greek chief and the same year crossed Hindukush to subdue the South Asia.

Table below shows dates of Alexander's conquest of Sindh and Punjab, retreat and death:

Defeat of Poros of Punjab	326 BC
Malians of areas north of Multan	326 BC
Oxydrates	326 BC
Musicanus	326 BC
Sambus submitted	326 BC
Sambus rebelled, was defeated and killed.	325 BC
Musicanus rebelled, was defeated and killed. Moeris-I and Moeris-II deserted their territories, poisoned wells and escaped.	325 BC
Anti-Alexander revolt starts in southern Sindh	325 BC
Submission of Arabitai	325 BC
Submission of Orientai	325 BC
Makran defeated Alexander by lack of food and water during the march to Babylon.	324 BC
Alexander's death (probably by poisoning)	323 BC
Dissolution of Alexander's empire	323-301 BC

TRADE

Like his predecessor Darius, Alexander decided to connect "Alexander's Heaven" (Barbarican or Banbhore), a port at the mouth of the Indus, with Mesopotamia and again Mesopotamia with Egypt via Red Sea and sent a fleet under Admiral Nearchus from Banbhore.

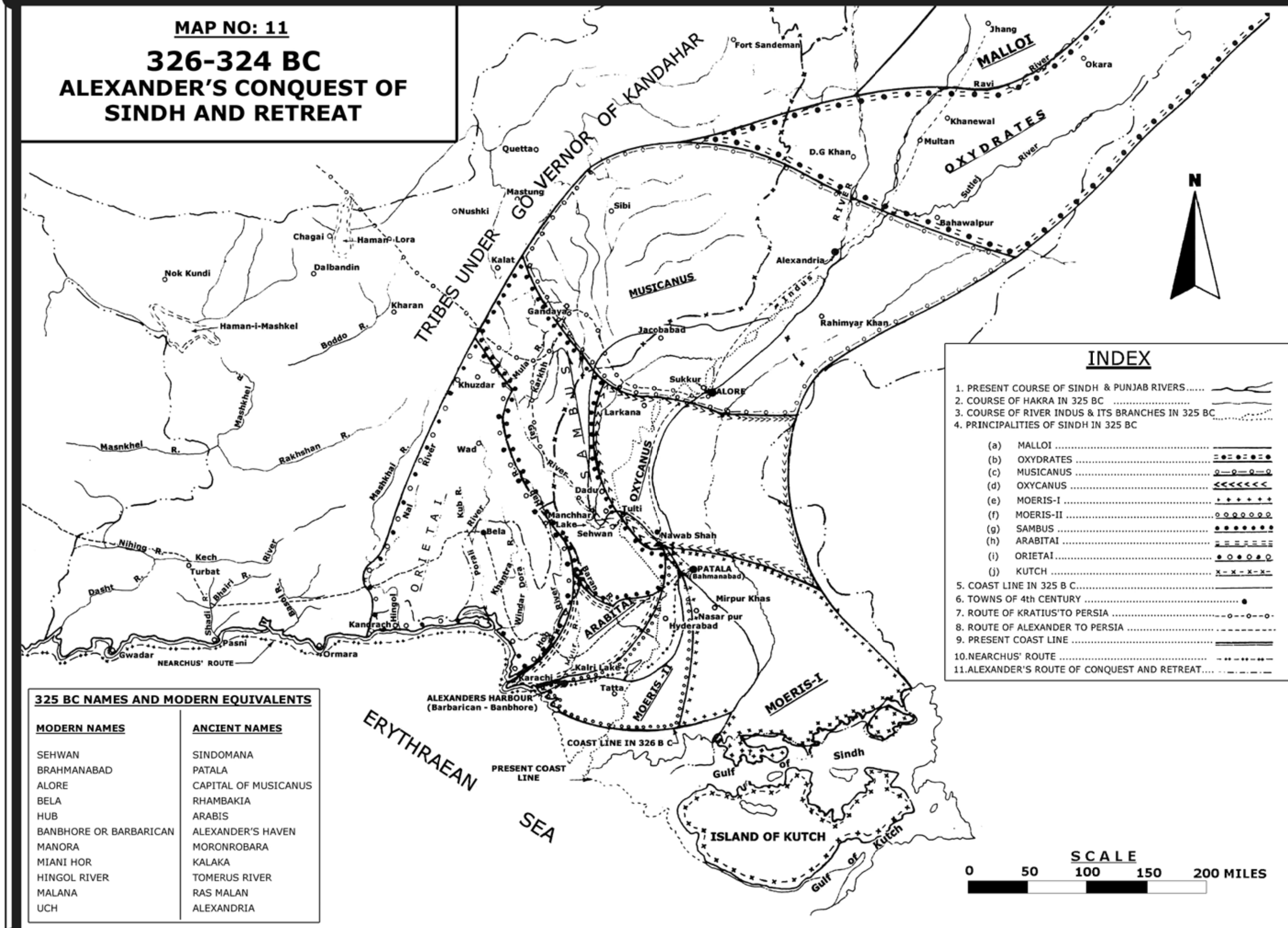
SOCIO - ECONOMIC IMPACT

There was little socio-economic impact of Alexander's conquest except Greek became language of learning and South Asian scientific and other literature and practices reached central Asia, Middle East and Europe. But his supporting of East and West assimilation failed as on his death all his soldiers married to Persian and Pakistanian women put them away and his son and wife were killed. He collected scientific information on Persian Empire and South Asia, which reached Europe.

Influence of Ayur Vedic medicines on Greek medicines and use of South Asian herbs and metallic

MAP NO: 11

326-324 BC
ALEXANDER'S CONQUEST OF SINDH AND RETREAT



325 BC NAMES AND MODERN EQUIVALENTS

MODERN NAMES	ANCIENT NAMES
SEHWAN	SINDOMANA
BRAHMANABAD	PATALA
ALORE	CAPITAL OF MUSICANUS
BELA	RHAMBAKIA
HUB	ARABIS
BANBHORE OR BARBARICAN	ALEXANDER'S HAVEN
MANORA	MORONROBARA
MIANI HOR	KALAKA
HINGOL RIVER	TOMERUS RIVER
MALANA	RAS MALAN
UCH	ALEXANDRIA

compounds in Greek medicines was major contribution of his conquest of South Asia.

WARM PERIOD AND CONQUEST OF SINDH BY PEOPLE FROM STEPPES

After 900 BC climate improved but not adequately enough to match cultural developments that were taking place in rest of South Asia. It seems that climate further improved from the last quarter of the sixth century BC to about 200 BC. This was a period when Sindh, which extended up to Multan, became prosperous and was conquered by Achaemenians to whom it paid heavy taxes, but within a hundred years of their rule it became independent under local principalities. When Alexander attacked Sindh in 326 BC seven principalities namely; Malloi, Oxydrates, Musicanus, Sambus, Oxycanus, Moeris-I and Moeris-II fought vehemently and shattered the greatness of the great conqueror and he had to leave Sindh in a rush through Makran desert, which finally defeated him with its treeless, waterless and unfriendly environments. He was finally poisoned in Babylon a year after he left Sindh. This only shows that if climate is good there is an increase in population added with prosperity and then people become ready to fight for the land to which they get so attached (Chronological Dictionary of Sindh).

Alexander saw and he conquered a number of principalities in Sindh. Interestingly, the boundaries of these principalities somehow seem to have coincided with well-defined irrigational boundaries of certain system as shown in the map enclosed and described below:

1. **Oxydrates' Kingdom** consisted of Multan district and Bahawalpur division up to Uch.
2. **Musicanus' Kingdom** consisted of Bahawalpur division (south of Uch), parts of Sukkur district (on the left bank of the River Indus), Jacobabad, Shikarpur and northern Larkana districts.
3. **Oxycanus' Kingdom** consisted of present Nawabshah and Khairpur districts.
4. **Sambus' Kingdom** consisted of Dadu and western Larkana districts most probably irrigated by the western branch of River Indus, Manchar Lake, some rain-fed streams in Johi and Sehwan talukas and hill springs. Because of the western branch and the Indus forming a vast Island the area must have been well irrigated and under perennial crops and therefore the richest area in Sindh.
5. **Kingdom of Moeris-I** on the eastern branch of the River Indus, which then was flowing through eastern Puran, consisted of Sanghar, Badin and irrigated tracts of Tharparkar districts.
6. **Kingdom of Moeris-II** on the western branch of the River Indus covered present Hyderabad and Thatta districts.
7. **Arabitai Tribal Area** consisted of Kohistan area of southern Dadu, northern Thatta and Karachi districts having rain-fed agriculture and pasture. Springs of the area must have been an important source of irrigation as they are now.
8. **Orientai** consisted of the present Lasbella area.

From Alexander's historians we get a clue to some changes in the course of the River Indus during that century. Arstobulus, his historian, mentions: "More than a thousand cities together with villages that had been deserted because the Indus had abandoned its proper bed and had turned aside into the other bed on the left, which was much deep and flowed with precipitous descent like cataract, so the Indus no longer watered by its overflows the abandoned country on the right - since the country was now above the level not only of new stream but also of its overflows." (Quoted by Strabo)

This change of course in Oxycanus' country took place between Alore and Patala i.e. in Khairpur, Naushehro and Nawabshah districts in the fourth century BC ruining the irrigational system in those districts. This must have weakened Oxycanus who used all possible tricks to win over the conqueror.

During this period Sindh had two river systems. Wilhelmy, the latest researcher on the courses of the Indus in Sindh, has stated: "In 325 BC the Sarsuiti-Hakra river system had ceased to be a perennial watercourse. It did flow in the inundation season (June to September) and occasionally received overflow water of the Indus, but it did not play any part whatsoever in the regular shipping." (Wilhelmy 1966-1968) It could have played role in growing sorghum and millet (short season summer crops) and pasture in its bed as water receded.

From the historians of Alexander following conclusion can be drawn:

- The countries of Musicanus (Machhis?) and Sambus (Sammas?) were rich due to irrigational system.
- The country of Moeris-I (Maurya-I) had two river systems and probably was the most fertile

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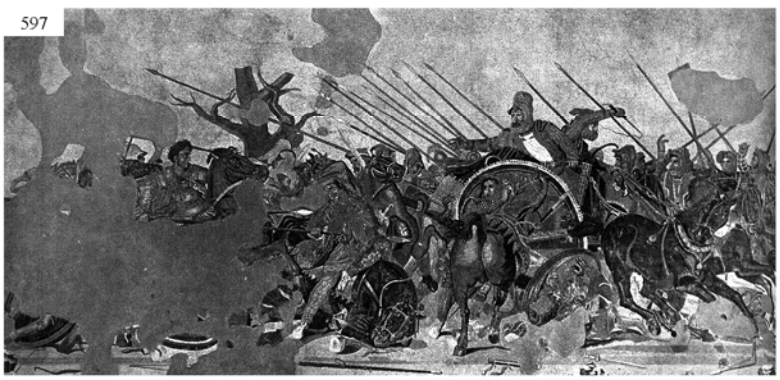
597
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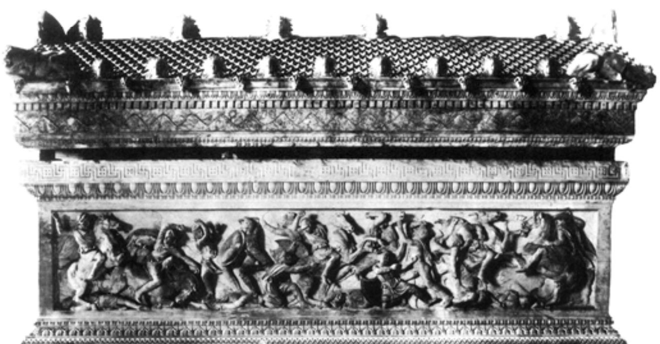
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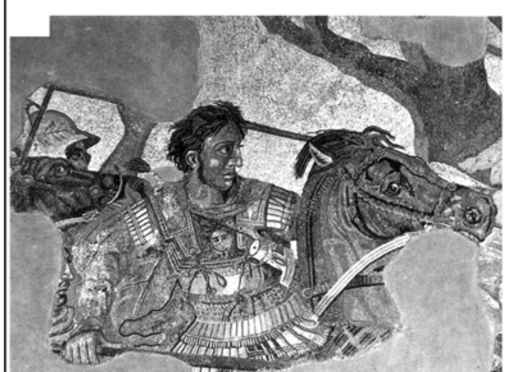

600

ALEXANDER

593. Alexander on horseback, 331 BC.
594. Hem of Alexander the Great, 330 BC.
595. Richard Burton in 1956 film 'Alexander the Great'.
596. Trunk charger. This coin Alexander on the horseback attacking two Indian warriors mounted on an elephant. It is thought to have been issued in Babylon in 323 BC.
597. The Alexander Mosaic, 1st century BC.
598. Alexander from a coin.
599. The Alexander Sarcophagus, late 4th century BC.
600. The Alexander Mosaic, 1st century BC.

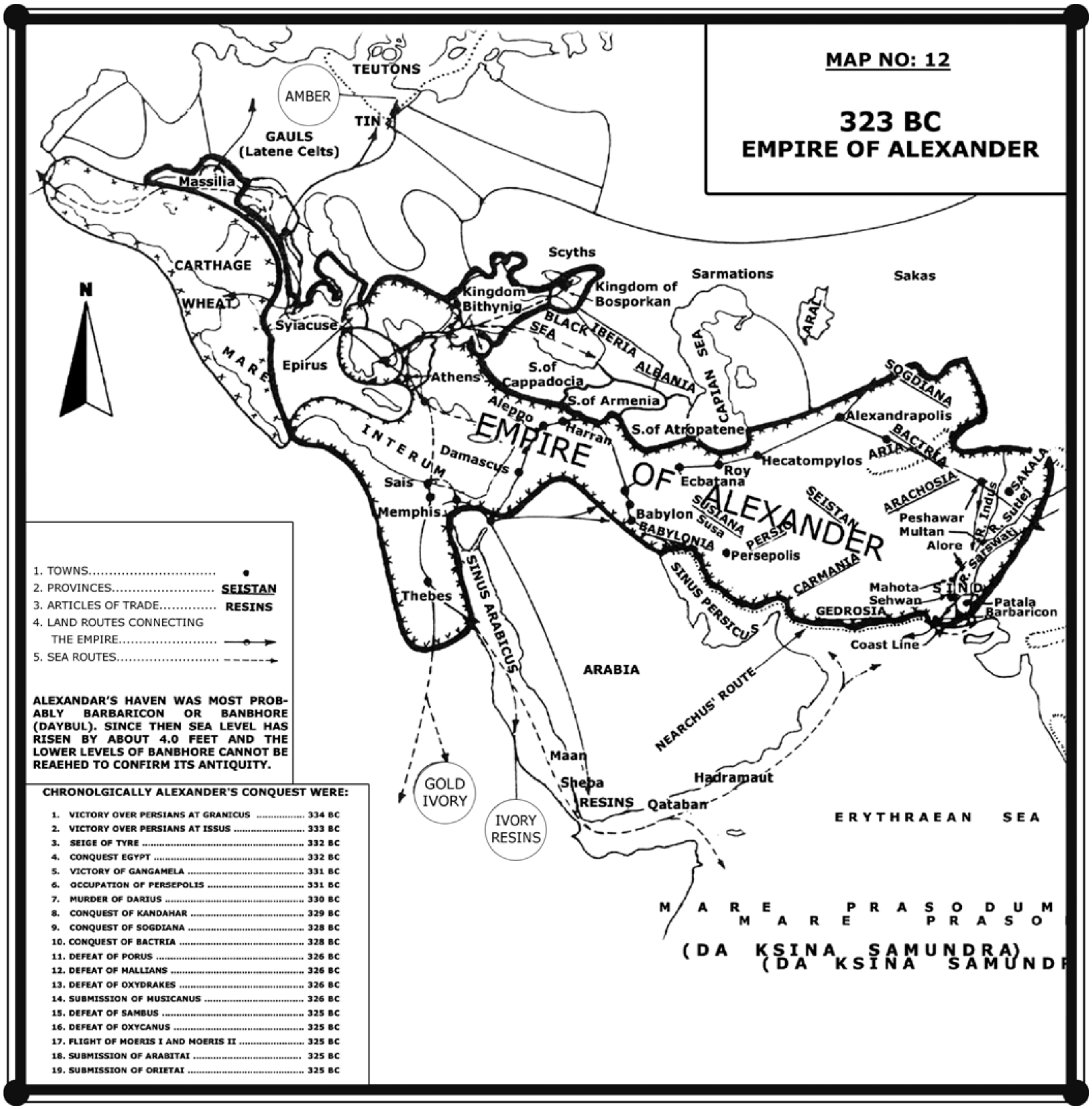
district.

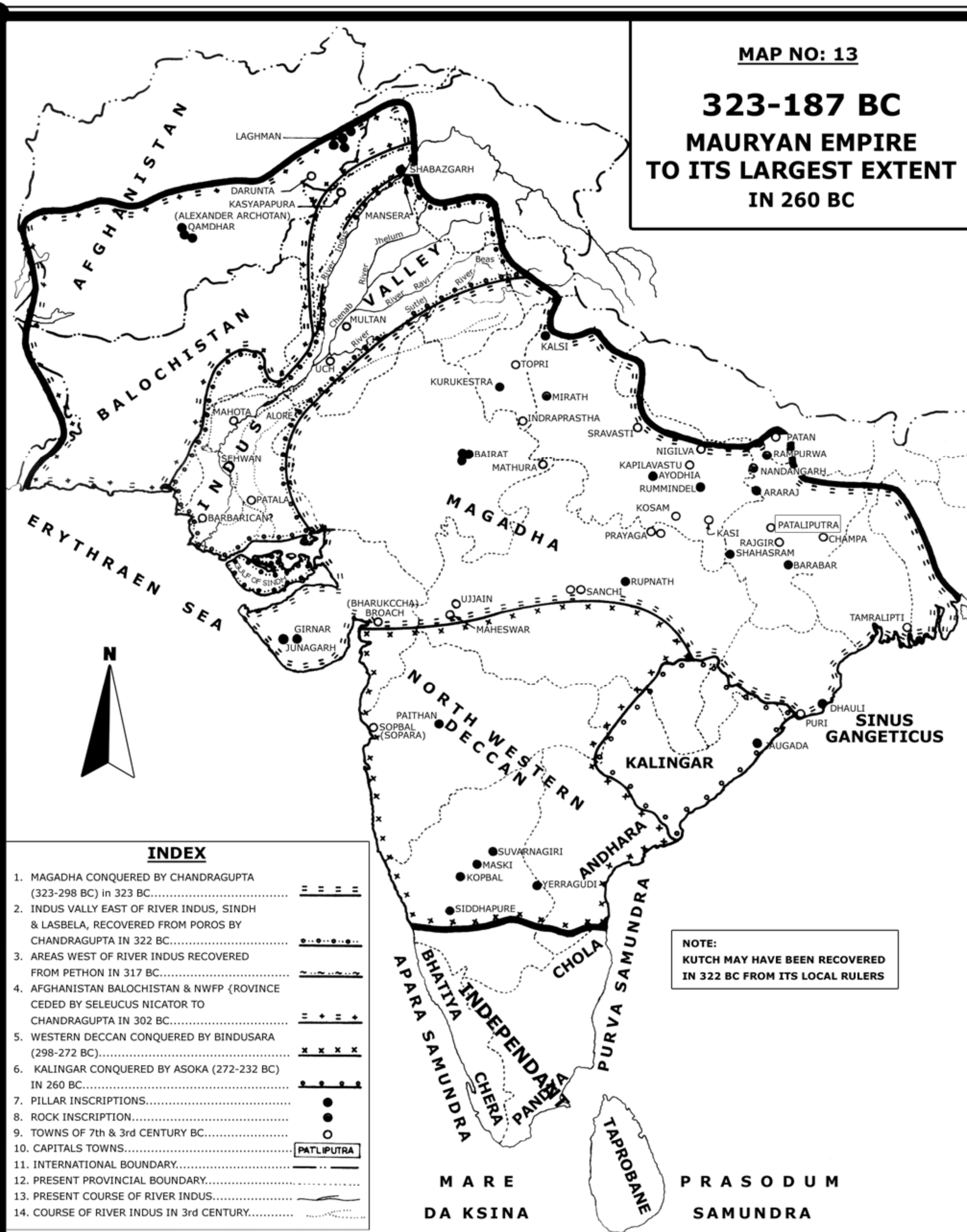
- The country of Moeris-II in the delta too would be well populated due to irrigation as well as large number of lakes and depressions, which provided fish, migratory birds and pasture for animal husbandry as water receded.

Sindh below Multan formed the richest part of the South Asia conquered by Alexander the Great.

This was mainly due to irrigation and two river systems in Sindh.

From Alexander's historians and journal of his admiral Nearchus we hear of two important products of Sindh namely; cotton textiles and sugar. Sugarcane as a perennial crop must have grown in suitable areas on irrigated system probably on the western branch of the Indus (the Western Nara), Manchar Lake zone and some other depressions and lakes like Makhi-Farash, Keenjhar, Kalri, Haleji and many others from which canals could lead to suitable areas and in the off-inundation season lifted by Bokas, as Persian wheels had not been invented.





MAURYANS CREATED THE FIRST SOUTH ASIAN EMPIRE WITHIN TWO THIRD OF A CENTURY AND LIKE ACHAEMENIANS MAINTAINED IT BY STRONG ADMINISTRATION BASED ON ARTHASASTRA OF KAUTILIYA. HE COULD NOT HAVE EVOLVED ALL THE THEORIES OF ADMINISTRATION, FOREIGN POLICY, LAW AND JUSTICE, TAXATION ACCORDING TO SIZES OF SLUICES AND LAND MEASUREMENT OVERNIGHT. IT SEEMS THAT ALL THESE METHODS OF GOVERNANCE WERE INHERITED FROM EARLIER CIVILIZATIONS INCLUDING THE INDUS AND EXPERIENCE GAINED BY ARYANS.THE EXTENT OF SAME EMPIRE WAS AGAIN ACHIEVED BY ALLAUDDIN (1315), AURANGZEB (1717) AND BRITISH (1849 AD).

CHAPTER 14

IRRIGATION UNDER MAURYANS; 321 - 184 BC

CHANDRAGUPTA MAURYA

Founder of Mauryan dynasty 'Moeris' of Greeks was Chandragupta Maurya who was brought from Magadha to Takasila (Taxila) by the Brahman Chanakya for education where he stayed for seven to eight years. According to Plutarch, Androkottos (Chandragupta) a youth saw Alexander himself and the former accompanied the latter to the battle of Jhelum against Poros. It was he who persuaded Poros to visit Alexander in response to latter's invitation, thus succeeded to bring about Poros to surrender to his advantage and as a result Poros became a good friend of Alexander, stayed with the latter until his departure form Patalene (the Lower Sindh) and was entrusted rule of Sindh.

POROS MURDERED, CHANDRAGUPTA ANNEXED SINDH IN 321 BC

Two years after Alexander's death and after throwing out the Greeks from the borders of present Sindh, Punjab and eastern Balochistan, Poros and Chandragupta Maurya seem to have gathered help from the leading principalities and tribes and also from Eudamus (who still controlled some area in the upper Indus valley) for invasion of Magadha. Poros, who controlled the Punjab and Sindh, also joined them and so did Sindh's princes' armies and tribes. They invaded all small states en-route to Magadha, which fell. After the victory the conquered lands had to be divided between Poros and Chandragupta. Chanak or Chanakya or Kautilya tipped Eudamus to murder Poros. Chandragupta annexed Sindh as far as eastern Gedrosia (Lasbella, Kalat, Sibi and southern Bolan Pass). Afterwards Chandragupta usurped the whole territory including Magadha in 321 BC. Peithon was made in-charge of the western frontier of South Asia i.e., west of the Indus.

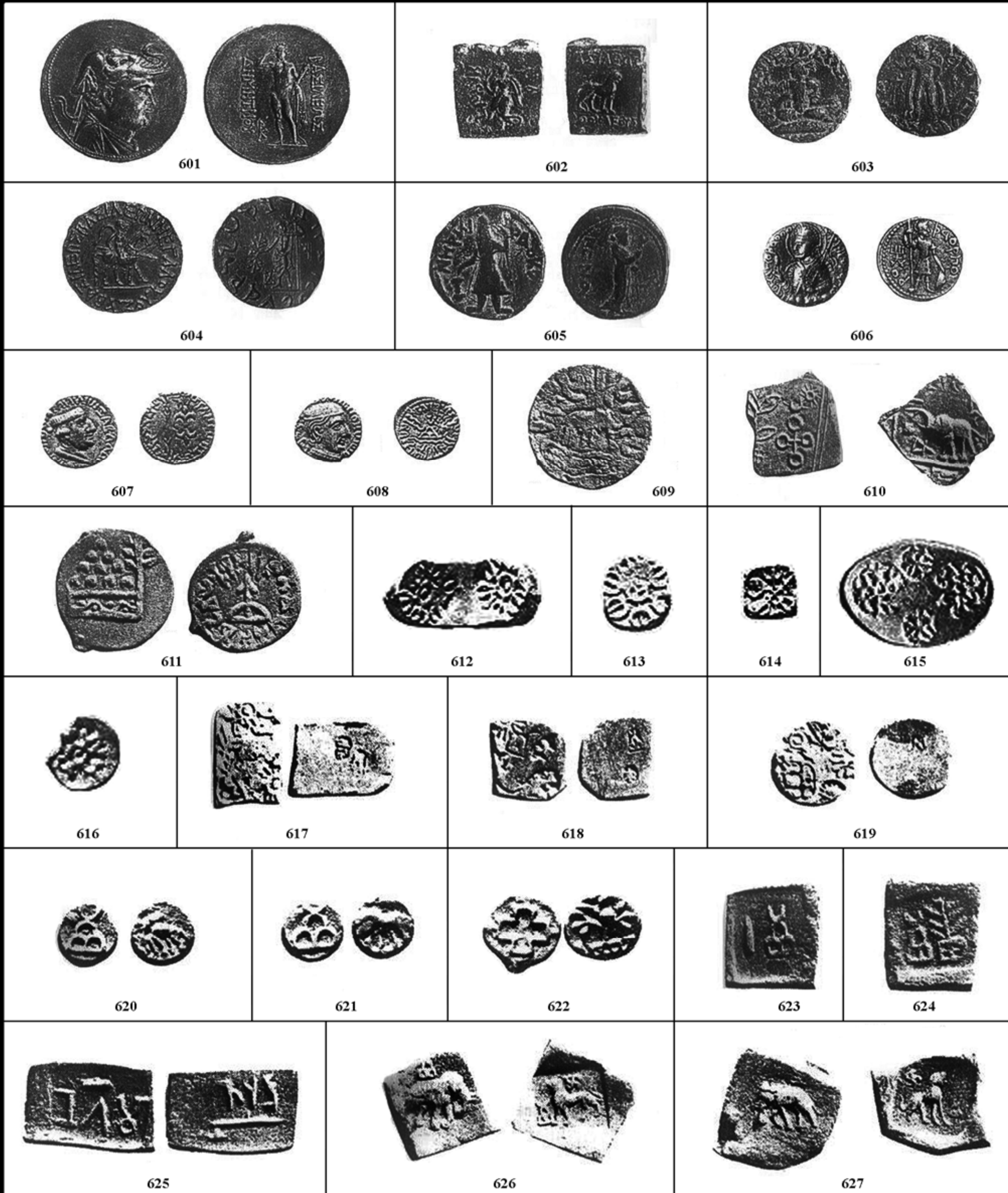
CHANDRAGUPTA EXTENDS MAURYAN EMPIRE TO AFGHANISTAN AND BALOCHISTAN IN 301 BC

Eudamus departed from the northern Punjab in 317 BC to aid Seleucus against Antigonus. In 305-304 BC Seleucus invaded present Pakistan and finally made a compromise with Chandragupta whereby the former ceded all Greek areas - east of the line connecting Jalalabad (in Afghanistan) to Porali river (in Lasbella district) in return for 500 elephants with which he defeated Antigonus at Ipsus in 301 BC. The outcome of this tragedy of Alexander's Greek successors was that Chandragupta achieved control of the scientific front of the South Asia i.e. Hindukush mountains. The British in the nineteenth century attempted in vain to have it and succeeded only after treaties with Afghanistan.

The rulers of Mauryan dynasty:

Chandragupta Maurya	324 – 298 BC
Bindusara	298 - 273/72 BC
Asoka	273/72 - 232 BC
Dasartha	232 - 224 BC
Sangata	224 - 216 BC
Salisuka	216 - 206 BC
Somasarman	206 - 200 BC
Salisuka	200 - 199 BC
Standhanwan	199 - 191 BC
Brihandrath	191 - 187 BC

With the advent of Mauryans came the improvement of land. The driving force behind this task was Chanakya; the Chief Minister of Chandragupta and the author of Arthasastra. In some



MAURYAN AND BACTRIAN GREEKS COINS

601. South Asian coinage: Indo-Greek; 602. silver tetradrachm of Demetrius-I, 200-100 BC; 603. bronze coins of Agathocles, 191-180 BC. Saka: 604. bronze coins of Azes, 57-10 BC; 605. silver tetradrachm of Azes. Kushan: 606. bronze tetradrachm of Kanishka, 100-126 AD; 607. gold stater of Huviska, 126-163 AD. Western Saka (Ksatrapa): 608. silver hemidrachm of Nahapana, 119-125 AD; 609. silver hemidrachm of Rudradaman Simha, 30-20 BC; 610. potin coin of a kinf (? Satakani), 30 BC; 611. lead coin of Gautamiputra Vilivayakura (Satakani), 106-130 AD.

Coinage ascribable to the pre-Mauryan period, 4th century BC, Northwestern regions: 612. silver bar coin (double standard); 613. silver round coin (half standard); 614. silver square coin Ganges Valley (Kesi); 615. cup-shaped silver punch marked coin; 616. silver punch marked coin.

Coinage ascribable to the Mauryan and immediately post-Mauryan period: 617, 618, 619. silver punch marked coins, national series; 620, 621, 622. copper cast coins; 623, 624, 625, 626, 627. die struck copper coins, Taxila; obverse Negama (Brahmi script), kojaka (Kharosthi script).

areas of his empire irrigation system was improved. The land revenue was correctly assessed by measurement of land and properly collected. The canal irrigation was known in Sindh since the times of the decline of Indus civilization, but it may have been extended to new areas by Mauryans. The earliest information on control of irrigation water by means of sluices also goes to this period and comes from Chanakya's Arthasastra and Magasthenes's Indica. They had Superintendent of Agriculture who assessed land rates according to its quality and method of irrigation. Normal share of government was one fourth of produce. Water rate, which was one fifth to third of produce, had to be paid as extra. This amounted to nearly half of gross produce. There were other minor taxes like tax on domesticated animals. So the farmer of irrigated land could not retain even forty percent of his produce. Pearls are mentioned as an item of trade of Sindh in Arthasastra, but Chanakya has overlooked cotton, textiles, spices and grains.

Magasthenes reports that imperial officers measured the land as in Egypt and inspected sluices by which water was distributed into canal so that every farmer got his proper share of water (V.A Smith from Strabo). Under Mauryans expenses on public works accounted for twenty-five percent of total expenses of the empire. For an exact picture of irrigational systems and areas in Sindh there is lack of information. Chandragupta Maurya started rebellion against Alexander from Sindh. The two rulers of the lower Sindh; Moeris-I and Moeris-II are now believed to be Mauryans (the tribe Morya still exists in Sindh). If this is so Chandragupta and Chanakya, his chief advisor, would both be very familiar with Sindh and being an able administrator latter who was a great political theorist of that early age would have further improved irrigated agriculture, which happened to be in a good shape already as Alexander witnessed in 325 BC.

After the great Mauryan Asoka's death in 242 BC under the latter Mauryans the irrigational system must have deteriorated probably due to mismanagement of irrigational works. The coins of latter Mauryans were debased and reduced silver content in them reflects on poor economy. Under a centralised system of Mauryan type weakening of overall economy will immediately result into less expenditure on irrigation, less land under cultivation and less income to the government. Thus, the vicious cycle would quickly weaken the government control.

The economy of Sindh and rest of South Asia was agrarian. Salaries of officials and expenditure on public works constituted a sizeable portion of nation's expenses. The fall of Mauryan dynasty is attributed to the economy being under considerable pressure to maintain large army and settlement on new land.

Around 250 BC bucket-chain bilge pumps were put in ships by the Greeks. They were similar to Persian wheels in design except that buckets were small and were manually operated by a crank rather than cog-wheel moved by animals. Persian wheels may have been introduced soon after on the same principle.

By 200-175 BC water wheels were already in use for irrigation. They may have been introduced in Sindh by Greek mariners between 200 BC and beginning of Modern Era or AD.

628

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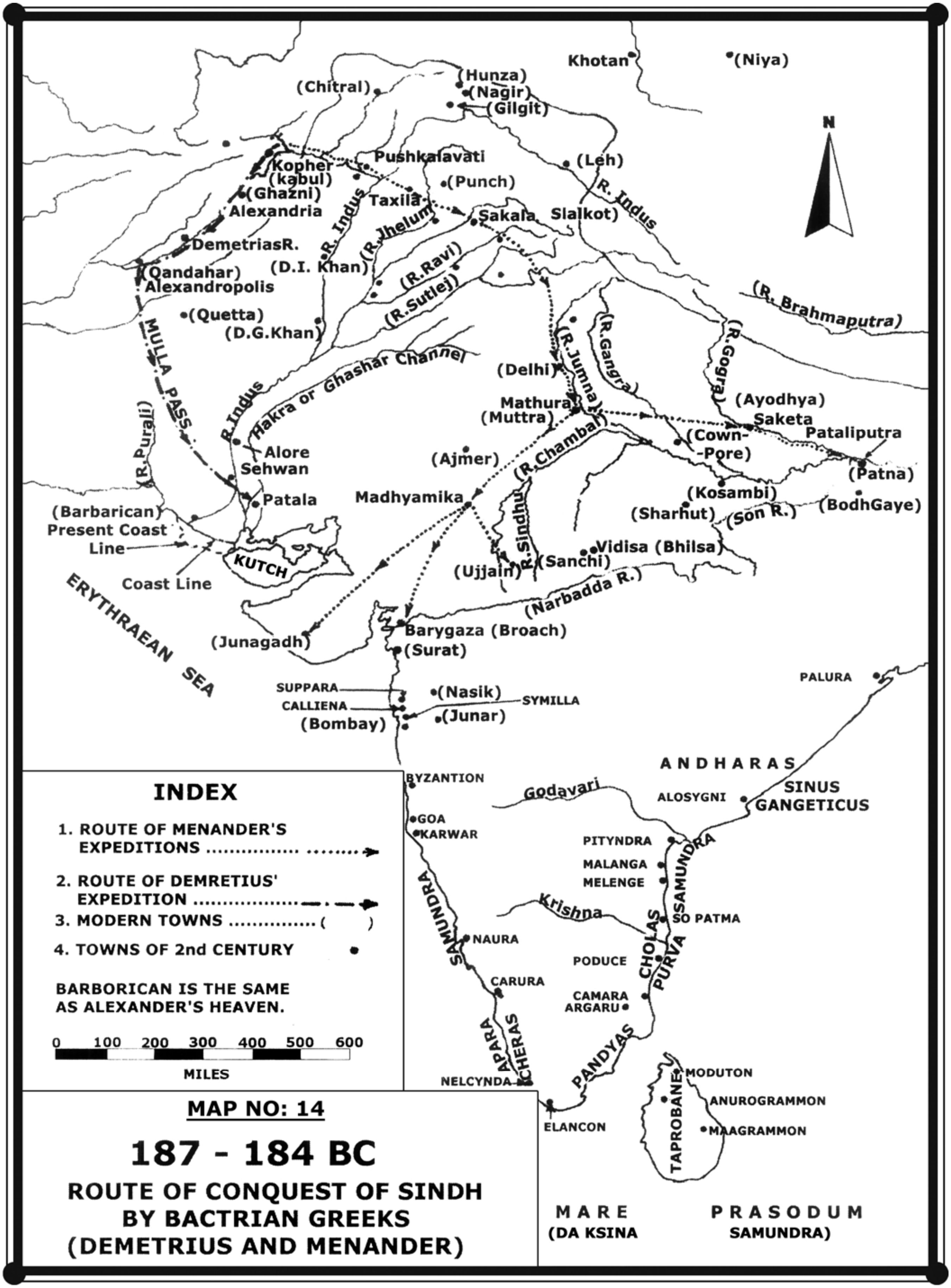
MAURYAN COURT OBJECTS

628. The elaborate luxury of the Mauryan court at Pataliputra is expressed by feminine fashion in a terracotta figurine .
629. Zodiacal bull.



MAP NO: 14

187 - 184 BC

ROUTE OF CONQUEST OF SINDH
BY BACTRIAN GREEKS
(DEMETRIUS AND MENANDER)

CHAPTER 15

IRRIGATION UNDER BACTRIAN GREEKS; 187 - 70 BC

Bactrian Greeks from Bactria (Balkh) settled by Achaemenians in fifth century BC on their borders to help in crushing anti-government uprisings exerted considerable influence and status that Alexander the Great proudly married their chief's daughter Roxanne in preference to any other woman from Greece or conquered lands.

The coming in of Bactrian Greeks in the South Asia was caused by natural historical circumstances of the fall of Mauryan Empire and division of their empire into a number of political regimes – each with its own ambitions. Sunghas the heirs of Mauryan Empire, actually Brahmans of Ujjain, were in the employment of Mauryans whose last king was assassinated by Pashyamitra Sungha to establish his dynasty, but they could not retain or regain the provinces, which had already ceded. Sunghas precariously controlled Magadha for a century and their successors Kaves held it similarly for another 50 years up to 28 BC.

By middle of the third century BC the Greeks of Bactria under Diodotos and Parthians of Iran broke away from Seleucid control and became independent. One of the dynasty's successors Demetrius son of Euthydemus conquered Kabul, NWFP, the Punjab and Sindh. His wars in the South Asia weakened his hold on Bactria, which became independent and he established himself in the South Asia. He conquered Archosia (Kandhar and surroundings) and eastern Gedrosia (Pakistanian Makran) and Appollodotus his lieutenant conquered the Punjab, Sindh and Kutch in 187-184 BC. He built a town Demetrius in the close vicinity of Brahmanabad or possibly renamed it as such. He ruled through his military governors posted at this city and he himself ruled from capital city of Taxila. Likewise his successors ruled from Taxila with governors at Demetrius.

His successor Menander became Buddhist and promoted that religion. In other words he accepted religion of the ruled instead of imposing his own. He established Indo-Greek power in addition to extending frontiers of his domain. His kingdom embraced Swat, Hazara, the Punjab (as far as Ravi), Sindh, Kutch, Kathiawar and most probably Kabul and Mathura near Delhi. Finally he became the hero of a Buddhist text 'Milinda-panho' wherein the king is converted to Buddhism. On his death 25 years later many cities vied for his ashes.

Under Menander the empire extended from Afghanistan to whole northern parts of South Asia down south to Broach and Mathura in the east.

Rulers of Bactrian Greeks in South Asia:

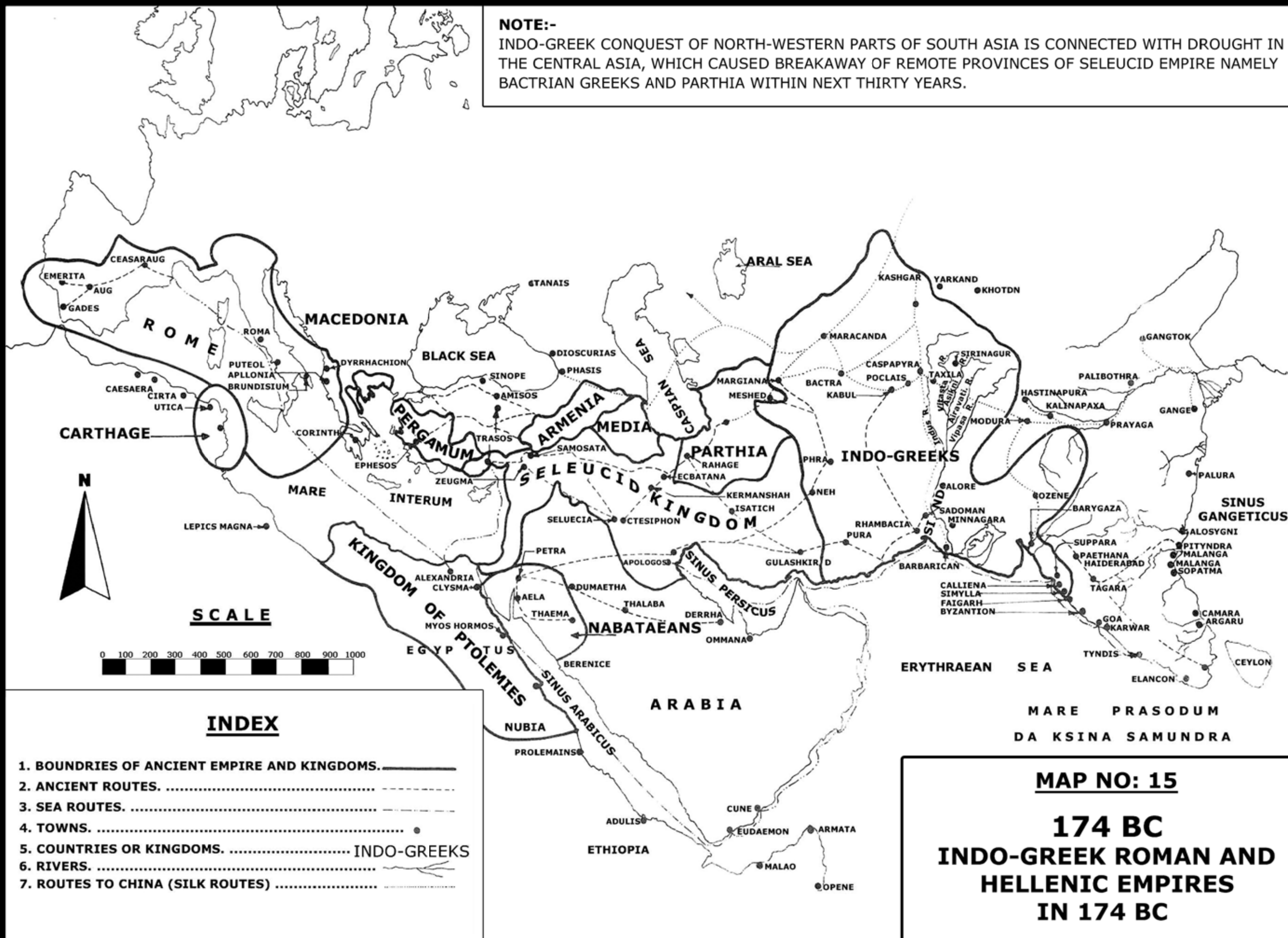
Demetrius	184 – 165 BC
Agathocle	165 – 160 BC
Menander	160 – 145 BC
Strato-I	145 – 100 BC
Appollodotus	100 – 90 BC
Zoilus, Dioysus and Appollophones	90 – 80 BC
Strato-II	80 – 70 BC

ARIDITY AND CONQUEST OF SINDH BY THE CENTRAL ASIAN TRIBES; 200 BC - 356 AD

The aridity prevailed again to various degrees up to about 400 AD. Whenever there is aridity over vast areas of the world the pastoral people from steppes pounce on the peaceful people of irrigated river valleys and in this case Sindh was occupied by the central Asian pastorals namely; Bactrian Greeks, Scythians, Parthians, Kushans and finally Sassanians of Iran. Their occupation became oppressive accompanied by local rebellions and they left few monuments in Sindh. Under them no Buddhist stupas worth the name were constructed as detailed in Chronological Dictionary of Sindh.

Bactrian Greeks ruled Sindh for hundred years. So far only a few events of this period based on numismatic evidence have come to light. Nothing is known about the irrigation during this period. Sindh had flourishing international trade mostly with

NOTE:-
INDO-GREEK CONQUEST OF NORTH-WESTERN PARTS OF SOUTH ASIA IS CONNECTED WITH DROUGHT IN THE CENTRAL ASIA, WHICH CAUSED BREAKAWAY OF REMOTE PROVINCES OF SELEUCID EMPIRE NAMELY BACTRIAN GREEKS AND PARTHIA WITHIN NEXT THIRTY YEARS.



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MAP NO: 15

174 BC
INDO-GREEK ROMAN AND HELLENIC EMPIRES IN 174 BC

Roman Empire through its port of Barbarican (Banbhore), which made the land rich and the government stable as the quality of coins proves, but it is difficult to assess anything about its irrigation and agriculture.

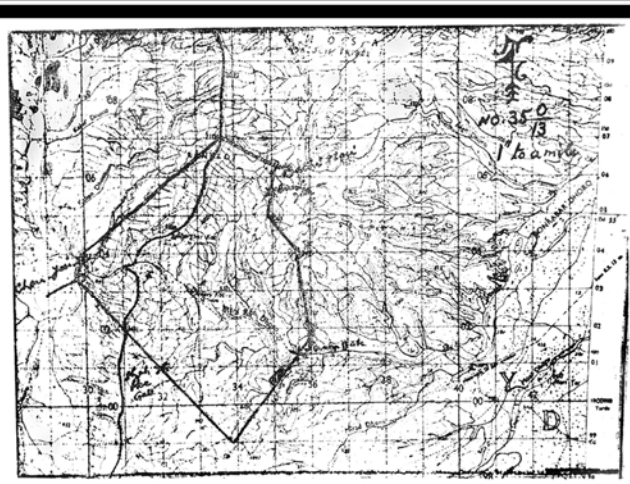
One important invention of the period was use of water wheel for irrigation in Asian countries on the southern coast of the Mediterranean Sea. Most probably it was a Greek invention. Between 250 to 200 BC bilge pumps came in use on large scale on ships to remove leaking water. These bucket-chain pumps made of bronze were soon put in ships in all seas. They were similar to present Persian wheels in design except that buckets were small and were manually operated by two handled crank rather than cog-wheel moved by animals. Prior to the invention of Persian wheel during Mohenjo Daro times Boka was pulled by a long rope over U-stand fitted on the edge of well. Pulley was invented after fall of Mohenjo Daro around 1500 BC. Cog-wheel was Achaemenian invention of sixth century or first quarter of fifth century BC. Persian wheel may have reached Sindh through Greek mariners who traded with Sindh and South Asia through Sindh’s port of Barbarican from 200 BC to 60 AD. It was most suited to Sindh’s irrigation from canals and wells and soon many hundreds must have been introduced. More than one thousand Persian wheels drawn by camels existed in surroundings of Baghban (five miles from Dadu) in 1522 AD, as captured by Shah Beg. In Arab countries it was known as Sindhi wheel due to its extensive use in Sindh.

Based on the design of bilge pumps and Persian wheels Philon a Greek scientist around 200 BC invented water wheel.

Sindh had canal irrigation system and supply of water to fields depended on level of water in the river, which fed the canals or depressions. The level of water was not favourable for supply to lands many times during the growing season. Boka is not efficient for lifting from small heights. Low lift Persian wheels proved to be very efficient and economical except for rice crop. Persian wheels were in use till opening of the Sukkur Barrage. They were in use occasionally for lift land until ten years ago. Centrifugal pumps with cheap diesel engine and electric motors have replaced them. It is expected that no Persian wheel will remain in Sindh in next ten years.

TRADE FROM 200 BC TO 200 AD

Sindh exported a large number of articles of local production and also imported. Those exported were: hides, furs, muslins, perfumes, unguents, pearls, precious stones (beryl, lapis lazuli), woollen clothes, lynx’ and snow leopard's skins, leopard skins, live elephants and their ivory, live tigers, lions, leopards, crocodiles, Sanda (a lizard of Sindh for its oil), humped cattle, musk or perfume of Gilgit deer, rhinoceros horns, oyster pearls, lac, dye, indigo, madder and other organic dyes finally silk yarn. Silk moth a native of Bengal and Assam reached China during Bactrian era where they succeeded in unravelling a single unbroken thread from its cocoon and developed it into commercially economical proposition. From 200 BC to 50 AD Egypt was leading importer and exporter of goods from Sindh and from Alexandria Egyptians re-exported goods to the Roman Empire.



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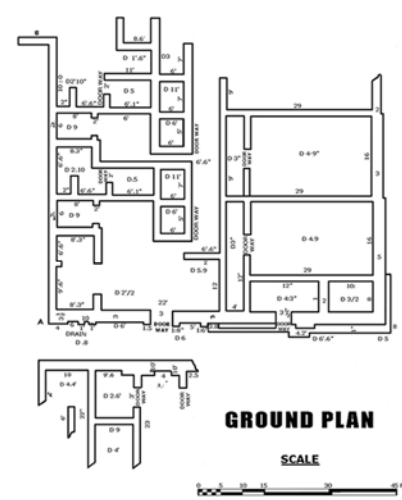
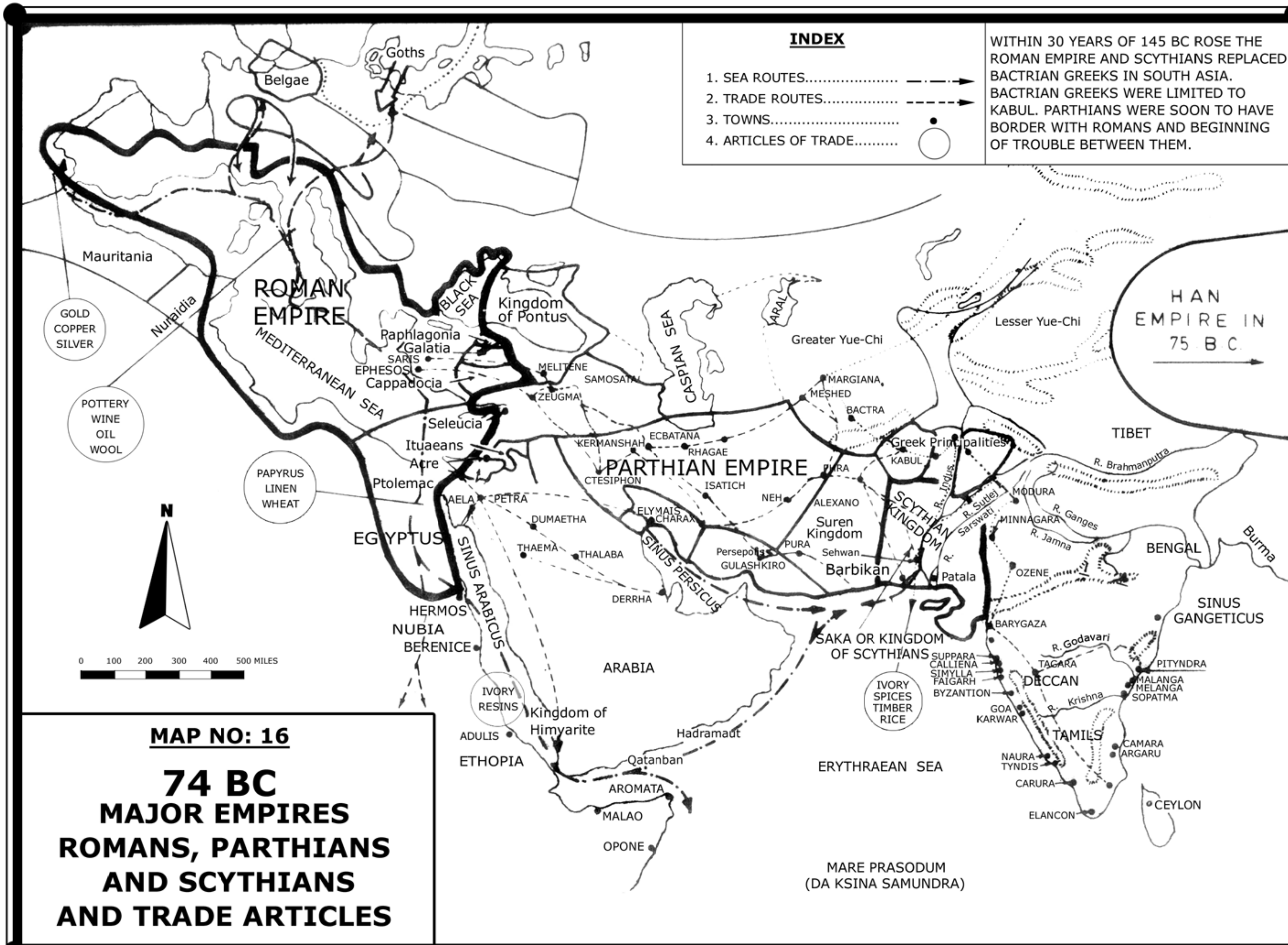


631

RANIKOT FORT AND BRAHMANABAD HOUSE

630. Ranikot fort circumference wall; photo from air.
631. Plan of a house at Brahmanabad excavated by Belasis in 1854 AD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Goths
Belgae
Mauritania
Numidia
GOLD COPPER SILVER
POTTERY WINE OIL WOOL
PAPYRUS LINEN WHEAT
ROMAN EMPIRE
MEDITERRANEAN SEA
BLACK SEA
Kingdom of Pontus
Paphlagonia
Galatia
SARIS
EPHESOS
Cappadocia
MELITENE
SAMOSATA
ZEUGMA
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Ituaeans
Acre
Ptolemac
AELA
PETRA
EGYPTUS
HERMOS
NUBIA
BERENICE
SINUS ARABICUS
IVORY RESINS
Kingdom of Himyarite
ADULIS
ETHOPIA
DUMAETHA
THAEMA
THALABA
DERRHA
ARABIA
Hadramaut
Qatanban
AROMATA
MALAO
OPONE
CASPIAN SEA
ARAL
KERMANSHAH
ECBATANA
RHAGAE
CTESIPHON
PARTHIAN EMPIRE
ISATICH
ELYMAIS
CHARAX
SINUS PERSICUS
Persepolis
GULASHKIRO
PURA
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ALEXANO
Suren Kingdom
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Greek Principalities
KABUL
SCYTHIAN KINGDOM
R. Indus
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Sarswati
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SAKA OR KINGDOM OF SCYTHIANS
IVORY SPICES TIMBER RICE
ERYTHRAEAN SEA
MARE PRASODUM
(DA KSINA SAMUNDRA)
Lesser Yue-Chi
HAN EMPIRE IN 75 B.C.
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R. Brahmanputra
MODURA
R. Ganges
MINNAGARA
R. Jamna
OZENE
BENGAL
Burma
SINUS GANGETICUS
BARYGAZA
R. Godavari
TAGARA
SUPPARA
CALLIENA
SIMYLLA
FAIGARH
BYZANTION
DECCAN
R. Krishna
GOA
KARWAR
TAMILS
NAURA
TYNDIS
CARURA
ELANCON
CAMARA
ARGARU
PITYNDRA
MALANGA
MELANGA
SOPATMA
CEYLON
N
0 100 200 300 400 500 MILES
MAP NO: 16
74 BC
MAJOR EMPIRES
ROMANS, PARTHIANS
AND SCYTHIANS
AND TRADE ARTICLES

CHAPTER 16

IRRIGATION UNDER SCYTHIANS; 70 BC - 46 AD

Scythians or Sakas, originally from Scythia a part of Central Asia and Iran, came to Sindh via Bolan Pass first and after conquering Sindh from Bactrian Greeks after 80 BC moved to conquer Kathiawar and northern Gujarat via Nagar Parkar. They also extended their kingdom first to southern Punjab and then north of Taxila in 77 BC. Gandhara was occupied in 60 BC. Their administration was based on Achaemenian model modified by Seleucids. Like Achaemenians they assigned fabulous titles to themselves.

The titles as gathered from various coins are: Dhramikasa or Dhramisa or Dhramisasa (just), Mahatasa (great), Mahatakasa (great prince), Rajadirajasa, or Rajarajasa (king of kings), Maharajasa (king of kings), Indravama (just to those born on the Indus), Putrasa (son of prince) and Strategasa (master of strategy of war). Since then these titles have been adopted by the South Asian rulers as essential administrative kit and have survived in these as well as other forms like Great Spirit, Great Leader, Father of Oratory and etc., assigned to rulers, political leaders and heroes of modern days.

The adoption of South Asian titles had started with Demetrius the Indo-Greek and had been continued by his successors, but the peak was reached under Scythians. Each one of those kings sometimes assigned more than half-a-dozen titles to himself. The Kushans and subsequently the South Asian kings followed up the practice. The Delhi Sultans (1206 - 1525 AD) dismissed the practice probably as extravagancy and were satisfied to be called Sultans only. With the Mughal kings and emperors the titles formed essential part of administrative recognition.

The following were the Scythians rulers:

Maues	70 – 58 BC
Spalyris	58 – ? BC
Azes-I	? – 15 BC
Azilises	15 – 10/5 BC
Spalyrises	10/5 BC – 10 AD
Azes-II	10 – 46 AD

Scythians retained Greek form of coins with Greek language on the front and Prakrit translation in Kharoshthi script on the back as their predecessors the Bactrian Greeks had done showing that masses did not know the official language. Under them Buddhist sculpture of South Asia underwent heavy Greek influence.

Scythians established armoured cavalry with long lance as main weapon of war used with tremendous thrust. Like Alexander and his father Philip’s Phalanx this was the latest superior weapon of the era and the reason for their superiority in war.

SOCIO-ECONOMICS, CUSTOMS AND ENTERTAINMENT

Anthropologists think that Sindh’s population belong to Indo-Scythian group (Sarkar: Races of the Punjab, Sindh and Balochistan. 1964). An earlier wave of Scythian migration to Sindh was around 850 - 800 BC when drought conditions in Scythia forced this migration, but this is not proved archaeologically.

After occupying Sindh hordes of them came to settle on irrigated lands. Some of agricultural products said to have been introduced by them from Iran and Central Asia were: onion, asafoetida (Adrak), garlic, oak-galls, coriander, shallot, fig, almond, Cummins (Jira or Zira), new varieties of water melons, carrot, pistachio, walnut, pomegranate and peach from Iran and pear and camphor from China. The twentieth century studies of germ-plasm of various crops put this theory in doubt. The hill tops in Johi and Khairpur Nathan Shah have wild pistachio and walnut trees. Scythians may have introduced modified cultivation of these varieties. This is a great possibility as they controlled areas on both sides of the Hindukush Mountains and better cultivators must have existed on the other side as they do now. Under them trade of Sindh with Roman Empire reached its peak through the deltaic port Barbarican (Banbhore). Sindh was shipping products of whole of north-western South Asia, Tibet and

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DOMESTIC DECORATION PIECES, COINS AND STONE WEIGHTS

632. Domestic decoration objects, 600 AD.
633. Ivory pieces of furniture excavated by Belasis from Brahmanabad, probably Sindhi cradle.
634. Hukka bowl, 19th century.
635. Julius Caesar, 100-44 BC.
636. Cleopatra, 30 BC.
637. Elected king, Philip, son of Amyntas III, began to re-plan the Macedonian state. His fine coinage spread far beyond his empire into central Europe.
638. Weights made of marbles and other stones, 2500 BC.

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DELHI SULTANS GOLD, SILVER AND COPPER COINS

639. Pre-reform Dinar, 695 AD (left) and post-reform Dinar, 696 AD (right) of Abdul Malik.
640. Silver coin of Humayun, 1530-1556 AD.
641. Gold coin of Akbar, 1556-1605 AD.
642. Copper coin of Shams-ud-din Iltutmish, 1211-1236 AD, and Ghiyas-ud-din Balban.
643. Copper coin of Raziya Sultana, 1236-1240 AD.
644. Silver coin of Akbar, 1556-1605 AD.
645. Zodiac coin of Jehangir, 1605-1627 AD, minted in 1613 AD.
646. Silver coin of Jehangir, 1605-1627 AD.
647. Silver coin of Shah Jehan, 1628-1658 AD.
648. Gold coin of Shah Jehan, 1628-1658 AD.
649. Gold coin of Mehmud of Ghazna, 997-1030 AD.
650. Copper coin of Sultan Mohammad bin Sam, 1192-1206 AD.

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GOLD AND SILVER SOUTH ASIAN AND EUROPEAN COINS

651. Fatimid Dinar of Al-Muiz, 968 AD.
652. Arabic coin of Abdul Malik, 691-693 AD.
653. Abbasid Dirham of Harun al-Rashid, 795 AD.
654. Silver tetradrachm of Demetrius, king of Bactria, with an elephant-skin headdress, 2nd century BC.
655. Gold coin of Shah Alam-II, 1760-1806 AD.
656. Silver coin of Shah Alam-II, 1760-1806 AD.
657. Silver coin of Aurangzeb, 1658-1707 AD.
658. Gold coin of Aurangzeb, 1658-1707 AD.
659. Gold coin of Akbar, 1556-1605 AD.
660. Early coin of India
661. Coin showing Cyrus, the king of Persia.
662. Early silver coins from Athens and Corinth, Greece.
663. Silver ingot, Nush-i-Jan, Iran.
664. The people of Aegina, an important Greek island trading city, were quick to see the advantages of the coinage being used in Asia Minor and, in around 560 BC, began to issue their own coins. These simple pieces of silver with a stamped design on one face were the first European currency. Double-faced coins soon followed and the idea spread to neighbouring cities of Greece, and later to Italy and westward.

Afghanistan. The agricultural products exported from Sindh consisted of lac dye, spices, red pepper, sugar, indigo, cotton linen, Sheesham wood, rice and sorghum. Besides the agricultural products Sindh also exported from its port Barbarican non-agricultural products like furs and skins from Himalayas and Tibet, precious stones, elephants, lions, leopards, rhinoceros, musk, crocodiles and oysters mostly to Egypt and Roman Empire. This indicates a well-established and managed irrigated agriculture. The Scythians had become Buddhists. Some Buddhist stupas are in Sindh, Kutch, Kathiawar and Gujarat.

Some of the crops mentioned above are perennial. The western branch of the Indus was perennial. Any canal from it will have low level in winter and may have needed wheel for lifting of water. The introduction of Sindhi wheel possibly could go to this time.

In 20 BC Vitruvius mentioned water mill showing that the use of water power reverse of bilge pump for grinding corn had begun for common use since 30 years before it. From bilge pump evolved the Persian wheel in that era.

Fan Sheng - Chih Shu wrote "An Agriculturist Book of China" in first century AD. This discusses basic principles of farming, treatment of seeds, date of planting of various crops, cultural practices, harvesting and storage.

KUSHAN, GUPTA, PARTHIAN, MUGHAL, BACTRIAN GREEK, ACHAEMENIAN CIONS AND KAURI

665. Kushan coin, 2nd century AD
666. Gupta coin.
667. Silver coin of Jehangir, 1605-1627 AD.
668. Kushan coin, 2nd century AD
669. Laxsmi on the coin of Samudra Gupta.
670. Zodiacal bull on a gold coin of Moghul Emperor Jehangir, 1605-1627 AD.
671. Coin of Menander, Bactrian Greek philosopher-king of north-west India, 115-90 BC. The reverse of the coin sows pallas Athene.
672. Reverse of a coin of Bahram-II, 276-293 AD.
673. Achaemenid gold daric, 5th century BC.
674. Early Parthian silver drachma. Possibly Mithradates-I, 171-138 BC.
675. Kauri (cowrie) used as currency up to early 18th century was abolished by the British. Kauri was equivallent to one rupee.
676. Parthian silver drachma on Mithradates-II, 123-88 BC, with the portrait.
677. Reverse of a drachma of Mithradates-I, representing Arsces.
678. Silver drachma of Ardasir-I, 224-241 AD.
679. Reverse of coin, showing a fire alter.
680. Silver drachma of Shapur-I, 241-272 AD.
681. Gold denarius of Khusrow-II, 590-628 AD.
682. Coin of Akbar, 1556-1605 AD.


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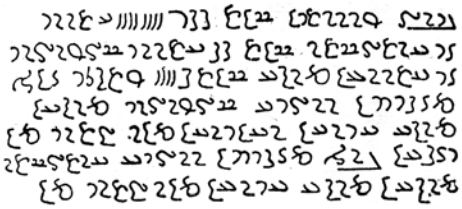
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SASSANIAN OBJECTS, PAHLAVI AND KUFIC SCRIPTS

683. Sassanian stucco plaque with rosette, from Bishapur.
684. Sassanian stucco plaque, from Umza' atir near Ctesiphon.
685. Sassanian Marlon of stucco.
686. Sassanian stucco plaque with boar's head, from Damghan.
687. Impression of a Sassanian seal showing a ram. Shape of seal; sphere of grey agate flattened at base
688. Impression of a Sassanian seal of carnelian showing a male bust.
689. Impression of a Sassanian seal of colourless chalcedony showing a hand holding a blossom. Shape of seal; sphere flattened on both sides and at the base.
690. Pot shreds with Dev-Nagri inscriptions used for measurement of volume of some commodities, from Banbhore.
691. Impression of a Sassanian seal of onyx showing a winged horse.
692. Pahlavi – Sassanian script.
693. Kufic inscriptions of Habari period, 907 AD, from Banbhore.
694. Silver bowl with Khusraw-I Anushirvan among dignitaries.
695. A Sassanian King in an armour, on a horse back, 590-628 AD.
696. Inscribed glazed pottery from Banbhore, belonging to Abbasid period or later.

CHAPTER 17

IRRIGATION UNDER PARTHIANS; 46 - 78 AD, KUSHANS (UPPER SINDH); 78 - 175 AD, PARTHIANS (LOWER SINDH); 78 - 175 AD AND THE WHOLE SINDH; 175 - 283 AD

PARTHIANS

Parthians were from Parthia a territory lying to the east of Caspian Sea and inhabited by hardy horsemen. They gained independence from Seleucids around 250 BC along with Bactrian Greeks and formed Parthian (Arskidan) dynasty of Persia, which lasted for five centuries till replaced by Sassanian dynasty. Two hundred years later they extended their domain up to where Achaemenians had in 519 BC. They annexed Sindh in 46 AD, but their rule was short lived and left no mark. The second Parthian dynasty ruler of Gujarat Rudradaman was an important king who controlled lower Sindh for 10 years (135-145 AD). The first dynasty of Parthians ruled for so less a period that hardly anything is known of their achievements in irrigated agriculture. Kushans ruled upper Sindh for nearly 100 years while Parthians were occupying the lower Sindh. After 175 AD Parthians ruled the whole Sindh for little over a century and were replaced by Sassanians.

Their kings were:

1.	Gondaphares (Punjab and Khyber Pukhtunkhwa)	20/21 – 50 AD
2.	Gondaphares (Sindh)	46 – 50 AD
3.	Pacores (Sindh, Punjab and Khyber Pukhtunkhwa)	50 – 65 AD
4.	Unknown Parthians (Sindh only)	65 – 78 AD
5.	Unknown Parthians and local dynasties	175 – 283 AD

The Indo-Parthian coins though inspired by Bactrians' coinage both in form and type are in general clumsy in execution with crowded designs of animals and human beings on them. They give the impression of local form and feelings. Equally noticeable are Barbarian elements in them. The coins depict economic and cultural decay and reflect fully on poor economic conditions due to drought.

Sindh was primarily Buddhist after Asoka as Bactrian Greeks, Scythians and Parthians had become Buddhists and had promoted this religion in their domain.

Hippalus, a Greek of Alexandria, sailed from Aden in Barbarican on the Indus delta and back without touching any port en-route in 45 AD. This produced a great revolution in trade with South Asia. This eliminated coasting of boats in the Erythrean Sea (Arabian Sea) and also land route up to Egypt via Tadmir. The Easterns knew about monsoon winds earlier, but Greeks had no knowledge about it. With this information and with help of south-west to north-east monsoon winds ships could leave the Red Sea in April for South Asian ports and start return journey in October with reverse winds. Periplus of Erythrean Sea, a guide book for mariners and merchants, was written around middle of the first century AD. It is an important source on trade winds and articles of trade from the port of Barbarican and mentions agricultural products exported from Sindh.

This discovery of six monthly cycle of monsoon winds had far reaching consequences for Sindh as soon afterwards ships were leaving the Red Sea for Indian ports direct and Barbarican lost all its importance. Because goods from ports on the west coast of India no longer had to be shipped to Barbarican in Sindh to coast along Persian Gulf and Arabian peninsula to Red Sea.

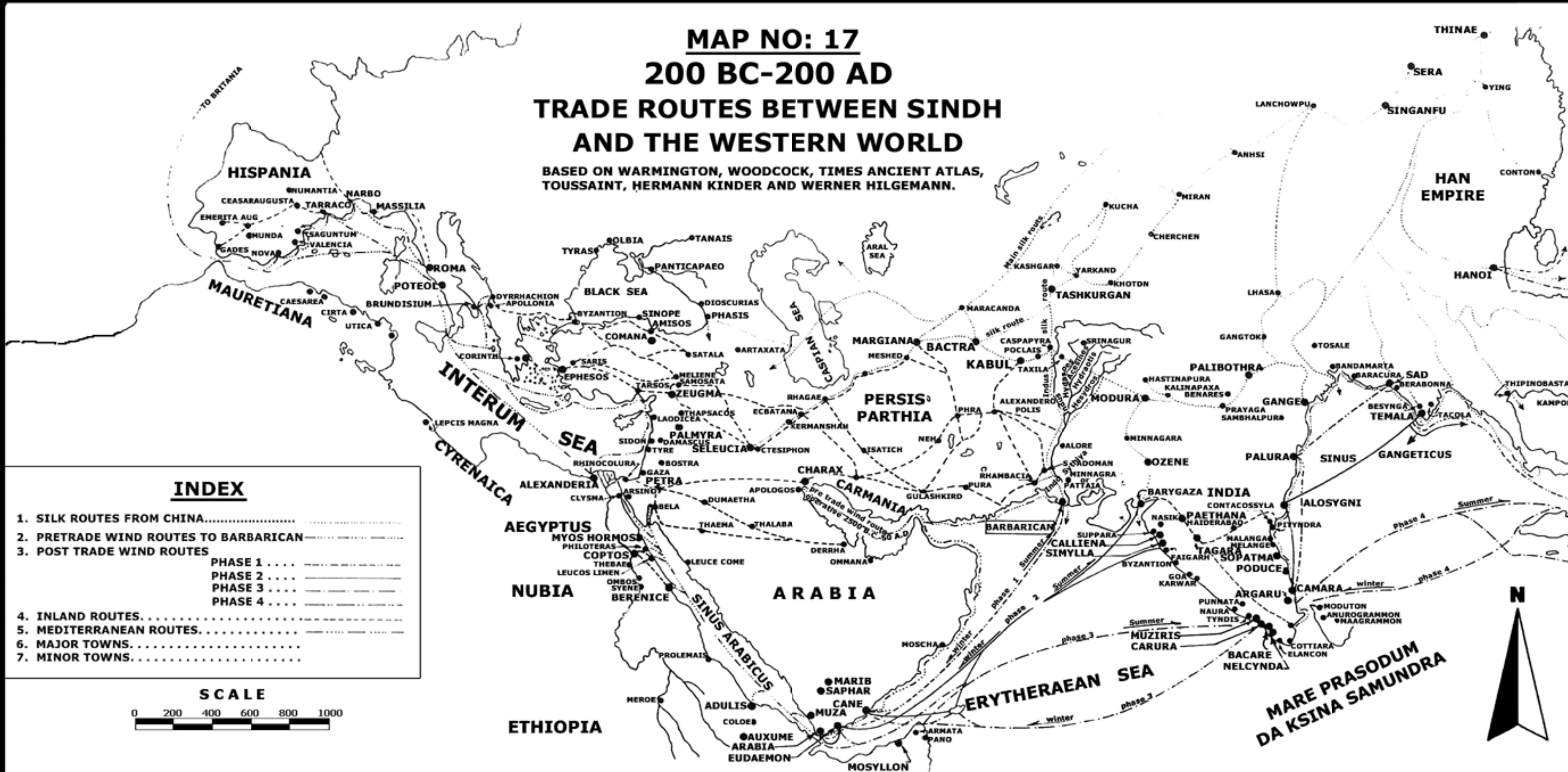
During the first 60 years of the Christian Era Sindh's trade with Roman Empire reached its climax. Roman records (Pliny and Periplus) show imports and exports of Sindh from its port Barbarican

MAP NO: 17

200 BC-200 AD

TRADE ROUTES BETWEEN SINDH AND THE WESTERN WORLD

BASED ON WARMINGTON, WOODCOCK, TIMES ANCIENT ATLAS, TOUSSAINT, HERMANN KINDER AND WERNER HILGEMANN.



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2. PRETRADE WIND ROUTES TO BARBARICAN
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   - PHASE 3 . . . .
   - PHASE 4 . . . .
4. INLAND ROUTES. . . . .
5. MEDITERRANEAN ROUTES. . . . .
6. MAJOR TOWNS. . . . .
7. MINOR TOWNS. . . . .

SCALE

0 200 400 600 800 1000

ANCIENT NAMES	MODERN EQUIVALENTS	ANCIENT NAMES	MODERN EQUIVALENTS	ANCIENT NAMES	MODERN EQUIVALENTS	ANCIENT NAMES	MODERN EQUIVALENTS	ANCIENT NAMES	MODERN EQUIVALENTS
ADULIS	ZULA OR PRESENT PART OF MA-	CANE	HISN GHORAB	HINDU KUSH MOUNTAINS	PAROPANISOS CAUCASOS	MYOS HORMOS	ABU SCHA'AR	RHAMBACIA	NEAR LASBELA
AEGIDIOI	-SSOWA	CAPE OR SPICES	RAS ASIR	INDO SYTHIA	LOWER SINDH	NAMMADOS	NEWBUDDA	RHINOCOLURA	EL ARISH
AELANA	GOA?	CARMANA	KERMAN	INTERNUM	MEDITERRANEAN SEA	NAURA	CANNANORE	SALIYUR	OPPOSITE TO NORTH END OF CEY-
ALEXANDRIA OF THE ARIOI	AKABA	CHERSONESOS	KARWAR POINT	ISTACHAE OR ISATICHAE	YEZD	NEILOPTOLEMAEON	TOKWINA	SARAPANA	-LON
ALEXANDROPLIS	HERAT	CHARAX	MOHAMMARAH	LEUCE ISLAND	PIGON ISLAND	NELCYNDA	KOTTAYAM	SERDICA	SCHARAPANI
AMISOS	KANDHAR	COPTOS	KEFT	LEUCOS LIMEN OR AL-	KOSSIER	NINOS	NINEVEH	SIGERUS	SOFIA
APAMEA	ESKI-SUMSUM	COPHEN OR ORTOSPANA	KABUL RIVER	-BUSPORTUS		OCELI ?	NEAR CELLA	SINOPE	RAJAPUR OR JAIGARH
APOLLONOS	BIREJIK	DAXATA	SINGANFU	LEUCE COME	EL-HAURA	ORAEA	SONMIANI BAY	SINGIDUNUM	SINAB
ARABIA ENDAEMON	WADI GEMAL	DOSAREN	ORISSA	MALAO	BERBERA	OZENE	UJJAIN	SOCOTRA	BELGRADE
ARACHOSIA	YEMEN AND ALSO ADEN	DRANGIANA	SEISTAN	MASALIA	MASULIPATAM	PAETHANA	PAITHAN	SADOMAN	DIOSCORICA
ARSINOE OR CLEOPATRIS	KANDHAR REGION	ECBATANA	HAMADAN	MARIB	MARIABA	PALIBOTHRA OR PATA-	PATNA	SUPPARA	SEHWAN
AVALITES	ARDSCHERUD. NEAR SUEZ	ARYTHAEREAN SEA	ARABIAN SEA	MARGIAN	MERV	-LIPUTRA	RAS BINA	SYENE	NEAR BOMBAY
BACTRIA	ZEILA	GANDHARA	PESHAWAR-RAWALPINDI AREA	MARACANDA	SAMARKAND	PANO	NEAR OR AT BAHMANABAD	SYRASTRENE	ASSUAM
BARBARICAN	BALKH REGION	GERRHA	KUWAIT	MODURA	MUTTRA	PATALA	ISTAKAR AFTER 200 AD	TABAE CAPE	KATHIAWAR
BARYGAZA	BANBHORE OR DEBAL	GOZA	GHUZZEH	MOSYLON	AT RAS HANTARA	PERSEPOLIS	DWEG	TAGARA	RAS CHENARIF
BERENICE	BROACH	GULF EIRINON	RANN OF KUTCH	MOSCHA	KHOR REIRI	PHALACRO	FURRAH FARAH	TYNDIS	KOLHPUR OR NAGRAM
BYZANTION	ON UMMEL BAY BELOW RASBENAS VIZADROG ?	GULF BARACE	GOLF OF KUTCH	MUNDUS	BANDAR HAIS	PHRA	PUSHKALAVATIOR TODAYS CHA- -RSADDA	ZAGROS MOUNTAINS	PANNANI
CAENEPOLIS	KENAB	HEROOPOLITE GULF	GULF OF SUEZ	MUZIRIS	CRANGANORE	POCLAIS	ON SWAT		JEBEL TAK
CALLIENA	KALYANA	HIERASYCMINOS	MAHARRAKA	MUZA	MOKHA	RHAGAE	NEAR TEHRAN		

(Banbhore). The imports were: woollen clothing, linen, aromatics, silver, gold, wine, plate glass and other glass ware and semi-precious stones and the exports were: cotton, silk (Chinese), indigo and other dyes, skins, furs from Himalayas and Tibet, semi-precious stones, wheat, rice, sugar, elephants, lions, leopards, rhinoceros, musk, crocodiles and oysters mostly to Egypt and Roman Empire.

The lower Sindh was called Patalene. The western branch of Indus leading to Barbarican was called Sagapa by Ptolemy and it played an important role in the international trade of Sindh's agricultural produce (detailed by this author in International trade of Sindh) through its port of Barbaricann. Barbarican was in existence at least since second century BC though it could go back to fourth century BC. Barbarican survived long enough to be renamed as Debal by the Persian Jews settled therein from third to thirteenth century AD. Debal was corrupted form of Deval or synagogue. Jews may have called their synagogue as Deval. This has not been unearthed by excavators.

KUSHAN RULE OF SINDH; 78 - 176 AD

Kushans originally Yue-che nomads having been thrown out from Chinese frontier in about 165 BC moved westwards in search of pasture for their cattle across Taklamakan or Gobi Desert and still westwards throwing out Scythians from the north of Syr Darya and finally settled in Bactria once occupied by Bactrian Greeks. In 78 AD they established their rule in the present Pakistan with capital at Peshawar which guarded Khyber Pass. The extent of their dominion was maximum under Kanishka-II covering Afghanistan, Hindukush and Pamir mountains to the north, Vindhia Mountains to the south and the Ganga valley in the east. They also conquered Khotan, Yark and Kashgar in Chinese Turkistan province. Kanishka conquered Kashmir.

Kushans drove out the Parthian king from Gandhara in 65 AD, but Sindh remained under Parthian control up to 70-80 AD - the probable date of writing of Periplus. Subsequent to this Kanishka annexed Sindh for a short period between 135-145 AD. Scythians conquered the lower Sindh, Kutch, Kathiawar and Malwa by 150 AD. Kushans may have re-conquered the lower Sindh, but Scythians recovered it and possibly the whole Sindh soon afterwards. Sakas or Scythians held Sindh probably for about 100 years. Their kings were:

UPPER SINDH

1.	Kanishka-I	78 – 101/2 AD
2.	Vasishka-I	102 – 106 AD
3.	Hurishka	106 – 119 AD
4.	Hurishka and Kanishka-II	119 – 138 AD
5.	Kanishka-II	138 – 145 AD
6.	Vasudeva-I	145 – 176 AD

LOWER SINDH

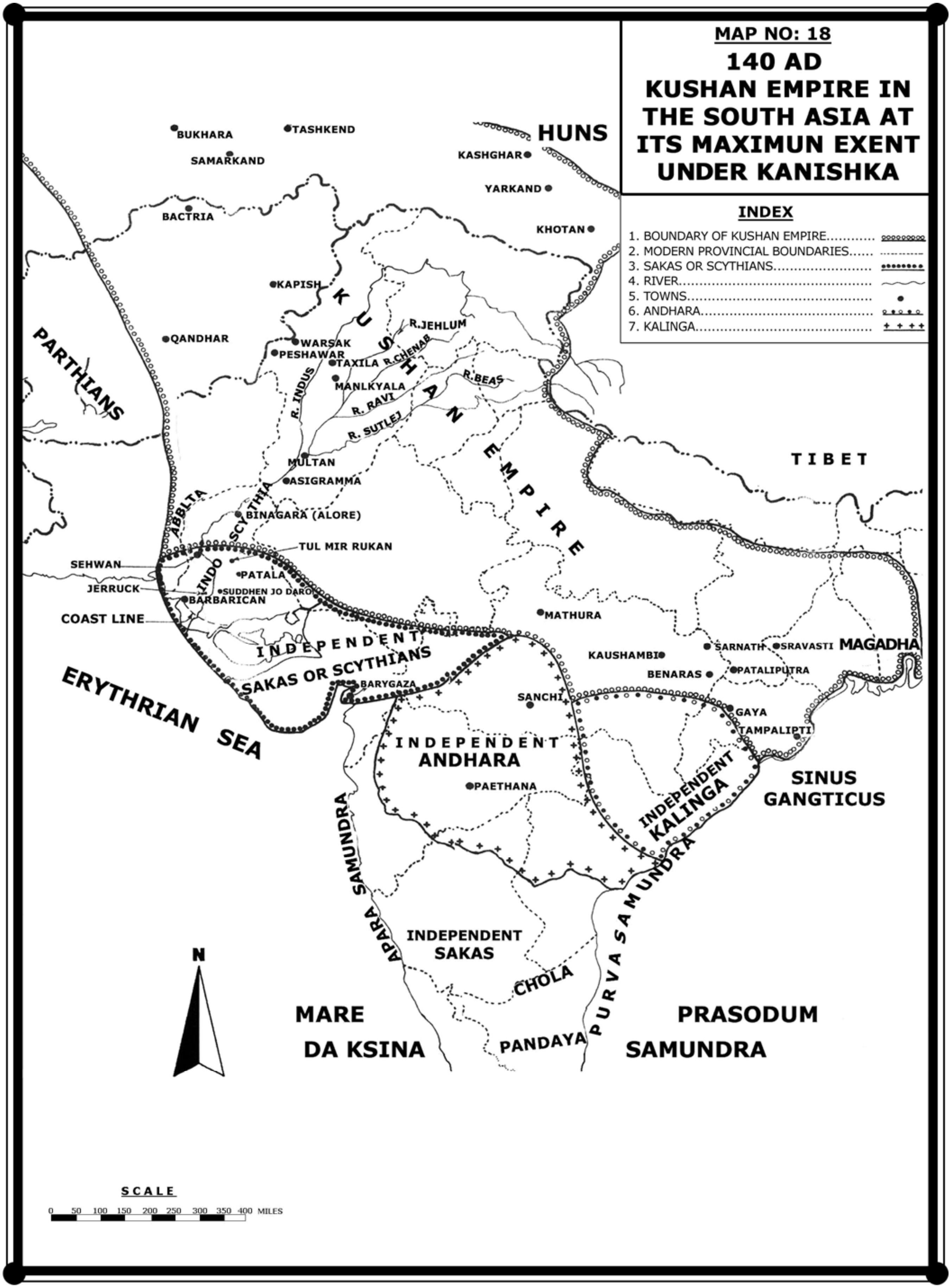
1.	Parthians	78 – 135 AD
2.	Scythians	135 – 145 AD
3.	Parthians	145 – 176 AD

Kushan emperors and their predecessors' feudatories adopted Sanskrit names and also the Indian titles like; Sachadharmathidasa, Yavagasa, Mahaisvaraso, Rajadirajasa, Sarvaloga, Isvarass, Tradtyasa, Maharajasa, Himakapisasa, Tradata etc., as these titles appealed the population at large. These and other titles having almost the similar meanings continued up to twentieth century in most of the Asiatic countries.

Official language of Kushans was Prakrit, which was used for inscriptions too. Sanskrit had been adopted as language of literary, scientific and religious writings though it had become a fixed language. All Buddhist religious writings from Kanishka to the twelfth century are in Sanskrit and the Buddhist contribution to it is probably no less than the Brahmanical.

Kanishka is reported to have been a new convert to Buddhism. He became promoter of that religion and struck coins with exiting images of Buddha with his name in Greek letters during the last years of his rule. This reflects his devotion. The Buddhism by that time had changed under influence of Zoroastrian, Indian, Christian, Gnostic and Hellenic elements and had been designated as Mahayana or the 'Great Vehicle'. In practice it converted Buddha into a god with ears open to the prayer of the faithful. It was to leave profound influence in Sindh and the southern Punjab where the new converts to Buddhism continued reverence to some old deities and new Yogis. Even the present belief in Pirs is its lingering influence and had been fully exploited by Ismaili Dawis, Sufis and their Fakirs.

Kanishka as royal patron of Buddhism called the


MAP NO: 18
140 AD
KUSHAN EMPIRE IN THE SOUTH ASIA AT ITS MAXIMUN EXENT UNDER KANISHKA
INDEX
1. BOUNDARY OF KUSHAN EMPIRE
2. MODERN PROVINCIAL BOUNDARIES
3. SAKAS OR SCYTHIANS
4. RIVER
5. TOWNS
6. ANDHARA
7. KALINGA
BUKHARA
TASHKEND
SAMARKAND
HUNS
KASHGHAR
YARKAND
KHOTAN
BACTRIA
KAPISH
QANDHAR
PARTHIANS
WARSAK
PESHAWAR
TAXILA
MANLKYALA
R. JEHLUM
R. CHENAB
R. BEAS
R. RAVI
R. SUTLEJ
R. INDUS
KUSHAN EMPIRE
MULTAN
ASIGRAMMA
ABBLTA
INDO SCYTHIA
BINAGARA (ALORE)
TUL MIR RUKAN
SEHWAN
PATALA
JERRUCK
SUDDHEN JO DARO
BARBARICAN
COAST LINE
TIBET
MATHURA
KAUSHAMBI
SARNATH
SRAVASTI
MAGADHA
BENARAS
PATALIPUTRA
INDEPENDENT SAKAS OR SCYTHIANS
BARYGAZA
ERYTHRIAN SEA
SANCHI
GAYA
TAMPALIPTI
INDEPENDENT ANDHARA
PAETHANA
INDEPENDENT KALINGA
SINUS GANGTICUS
APARA SAMUNDRA
PURVA SAMUNDRA
INDEPENDENT SAKAS
CHOLA
PANDAYA
N
MARE DA KSINA
PRASODUM SAMUNDRA
SCALE
0 50 100 150 200 250 300 350 400 MILES

'Fourth Buddhist Council' to discuss matters regarding Buddhist theology and doctrines.

Markandeya Brahmanda and Vovu Purana were revised by Brahmans to meet Buddhist challenges.

In this period the Brahmans adopted some doctrines from Buddhism, accepted eating of meat of some animals and transformed their religion into what is now known as Hinduism. This reformation gained such momentum that the Kushan king Vasudeva (146-176 AD) volunteered conversion to Hinduism in 145 AD. However, it was not the later Kushan but the Guptas (270-500 AD) under whom Hinduism started pushing Buddhism out of the South Asia. They were responsible for revival of the old Upanishad religion into what was hereafter termed as Hinduism - a word coined by about the same time.

Chinese began making paper in the first quarter of second century AD. "Periplus of Erythrean Sea" a Roman treatise written as guide book for trade and sea travel from the Red Sea to East Indies was written around 70-71 AD. Some authorities think that it was written 10 years earlier and others put 10 years later. Still others think it was written in 110-115 AD. The book gives some interesting details on Sindh like Barbarican (Banbhore) a port on a mouth of the Smithus (Sindhu or Indus), Minnagara (Brahmanabad?) as main town held by Parthians and the lower Sindh as Sicapide or Scythia or land of Scythians. Sindh's imports mentioned therein were: figured lines, topaz, coral, storax, frankincense, glass vessels, silver and gold and exports were: indigo, cotton, silk, furs, nard, gum, perfumes and etc.

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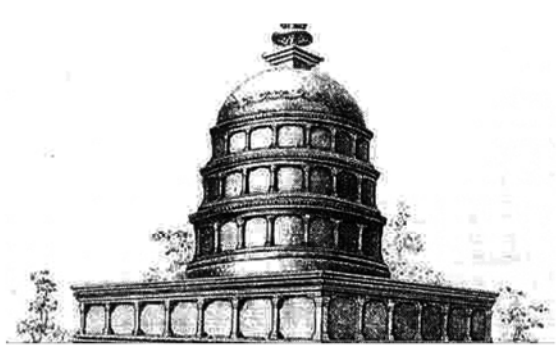

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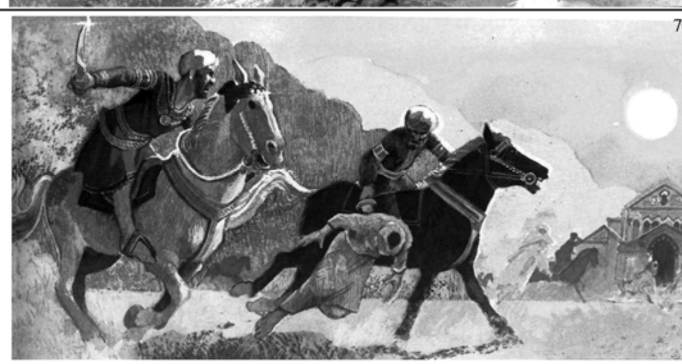

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MOHENJO-DARO STUPA, PARTHIAN AND ARAB WARRIORS

697. Conjectural restoration of stupa at Mohenjo-daro, 1st century AD, according to Marshall.

698. The skill of their mounted archers enabled the Parthians to halt the Roman advance. They defeated many armies with their famous 'Parthian Shot'. The cavalry would pretend to retreat encouraging the enemy to follow them, then the Parthians would turn in their saddles and fire arrow onto the pursuing army, 1st century AD.

699. Parthian shot. A bronze figure shows a mounted warrior turning to loose an arrow at a pursuer.Through this feat of horsemanship the Parthians, who come from Scythia, gave their name to a missile or comment delivered in retreat, 70 BC.

700. Arab soldiers sweeplarge areas of old Achaemenean Empire, Nothern Africa and Spain within a century of birth of Islam.

701. A Parthian shooting at the gallop, 1st to 3rd century AD. Parthians, of mixed Persian, Mongolian and Bactrian descent, played their part in the Indo-Hellenistic encounter and established a local dynasty at Taxila.

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RELIGIOUS POSTURES, STRUCTURES, OBJECTS AND HSUAN-TSANG

702. Brahma from Kahujo Daro Mirpurkhas, having four faces instead of traditional three. The finding shows influence of Hinduism and co-existence with Buddhism up to the end of 13th century. (Cousens).
703. Jain Temple Bhodhesat, 1375
704. Hsuan-tsang, a portrait from the Tun-huang (thousand Buddhas) cave, western Kansu, China.
705. Ghori temple New Viravah 1440
706. Deity called demon and Arabic inscription around it. (DGA).

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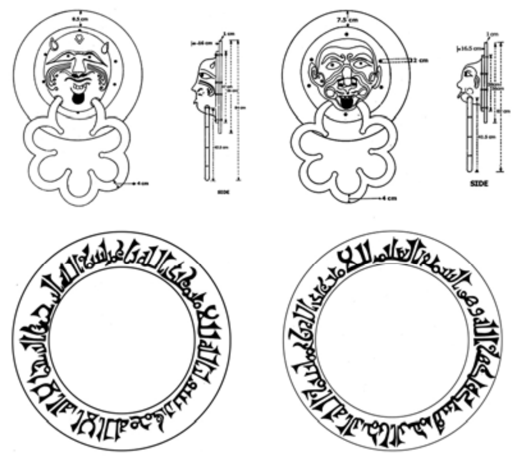

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CHAPTER 18

IRRIGATION UNDER SASSANIANS; 283 - 356 AD

SASSANID RULE OF SINDH (283 - 356 AD)

Sassanids ruled Persian Empire from 176 AD to 651 AD. From 519 BC to the end of third quarter of second century AD Sindh was ruled by Achaemenians, Alexander, Mauryans, Bactrian Greeks, Scythians and Parthians. Between 519 BC and 76 AD Kushans ruled Sindh at least for some period during the reign of the Parthian dynasty. All these dynasties held some part of Achaemenian Empire or the Greater Persia. The Sassanian Empire in its largest extent spread from Mesopotamia to Khurasan, Balochistan and Afghanistan. It was therefore presumed that like their predecessors they must have conquered Sindh too and retained it during their glory. This statement is erroneous. This was also period of decay of Kushans who, it is presumed, could not have controlled Sindh. Kutch was ruled by Rudradaman the Parthian and his successors between 135-395 AD. There is no evidence of their advance into Sindh. Guptas of Malwa rose in 270 AD and they too did not control Sindh. There is some evidence of Sassanian rule of Sindh between 283-356 AD. Thus, it is safe to assume that Sindh was probably ruled by small independent principalities between 176-283 AD.

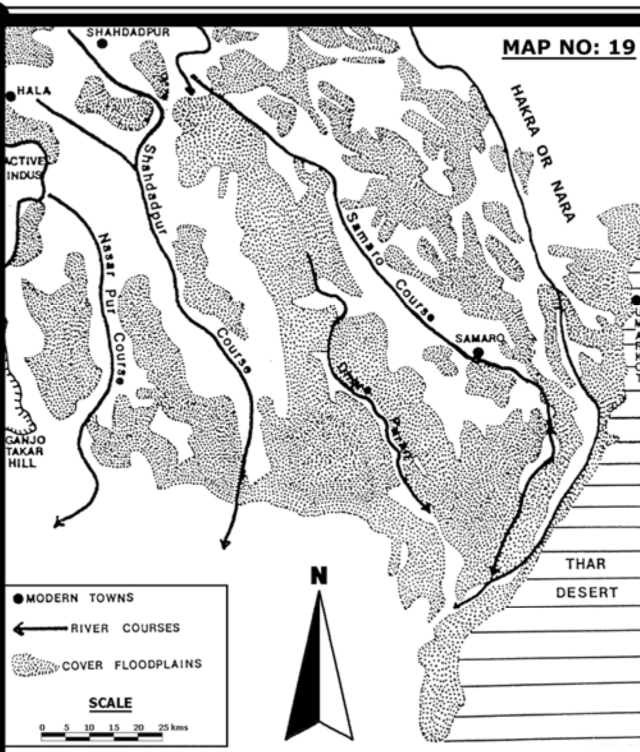
The Sassanian rulers during occupation of Sindh were:

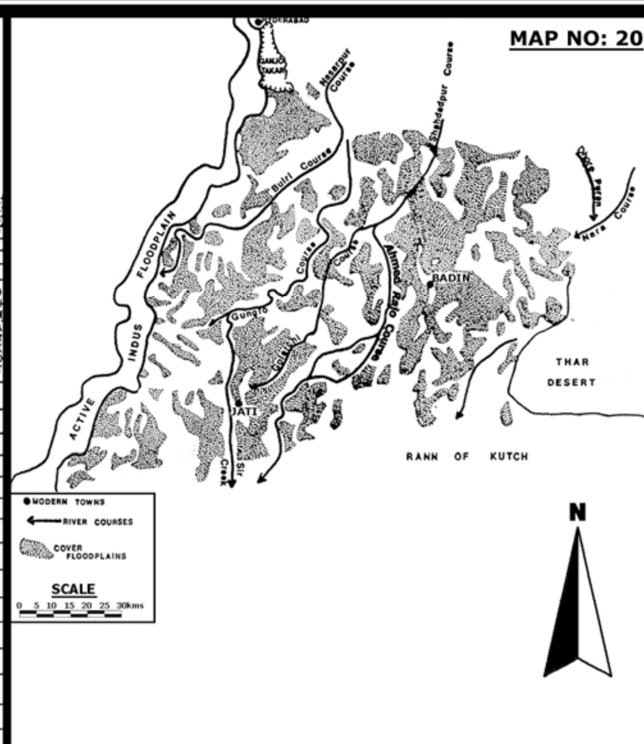
1.	Vahram-II	276 – 293 AD
2.	Norshih	293 – 302 AD
3.	Hormuzd-I	302 – 309 AD
4.	Shahpur-II	309 – 379 AD

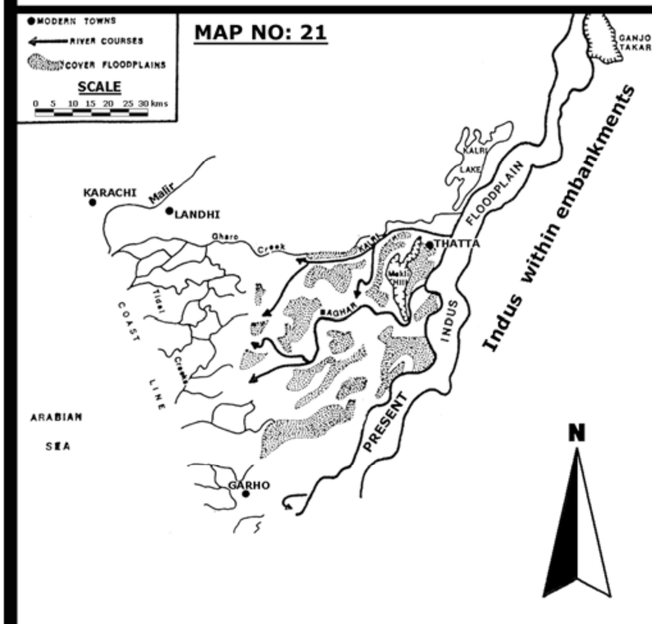
Sassanian invasions of the South Asia started in the reign of Ardashir, but it did not include the lower Indus valley of which the upper parts were captured at the time of Shahpur and the lower Sindh probably during the rule of Vahram-II (276-293 AD). In 283 AD Vahram-II's empire included Makran, middle (present west Punjab) and lower Sindh region, Kachehha (Kutch), Kathiawar and Malwa.

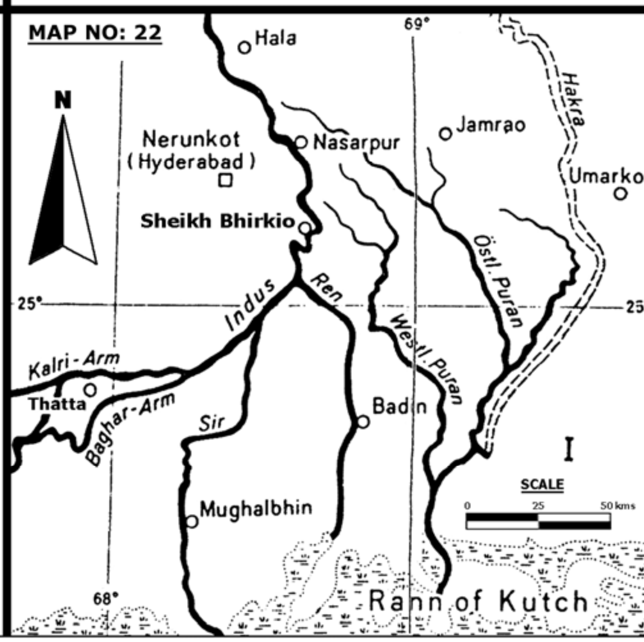
In 265 AD Hormuzd rebelled against Vahram-II and the former was helped by Sakas (Scythians) and Kushans. Vahram-II crushed the rebellion, conquered whole Sakastan and appointed his son Vahram-III as Shahanshah (king of Sindh, Kutch, Kathiawar and Malwa). Sindh may have joined Scythians and Kushans against Sassanians and became independent. This may have been the re-conquest of the area by Vahram-II. In 356-57 AD Shahpur-II invaded the South Asia defeating Kindra king of Punjab in 357 AD and then reducing Kutch and Kathiawar using Sindh as base. However Kathiawar, Kutch and Malwa soon became independent and were reduced by Chandragupta-II Vikramaditya between 388 and 397 AD. Vikramaditya may have invaded the deltaic area of Sindh as Mehrauli iron pillar inscription shows that he crossed the seven mouth of Indus, which meant the area below delta head. But this must have been a raid rather than conquest of capital, which most probably was at Brahmanabad or Alore at a distance of 100 and 270 miles respectively from deltaic area. Sindh was ruled by Vahlikas who were very powerful. Thus, Sindh may have gained independence soon after 356-57 AD. There is mentioned that Vahram - Gor (420-440) acquired Sindh as dowry from a South Asian king whose daughter he married. This shows that Sindh was not under Sassanid control between 356-420 AD. Sindh was not part of any empire of South Asia and therefore the statement is doubtful.

In days of Harshavardhana, Pulakesi and Chaulkayas the Indian mariners carried their commercial activities right up to Japan. Sindh must have been exporter of its conventional products i.e., indigo, dyes, textiles, rice, cotton, sugar (as medicine), spices and probably furs and hides and products of Afghanistan, western Tibet and Sinkiang like opium, furs and Chinese silk. The secret of textile colours lay in preparation of fast dyes from







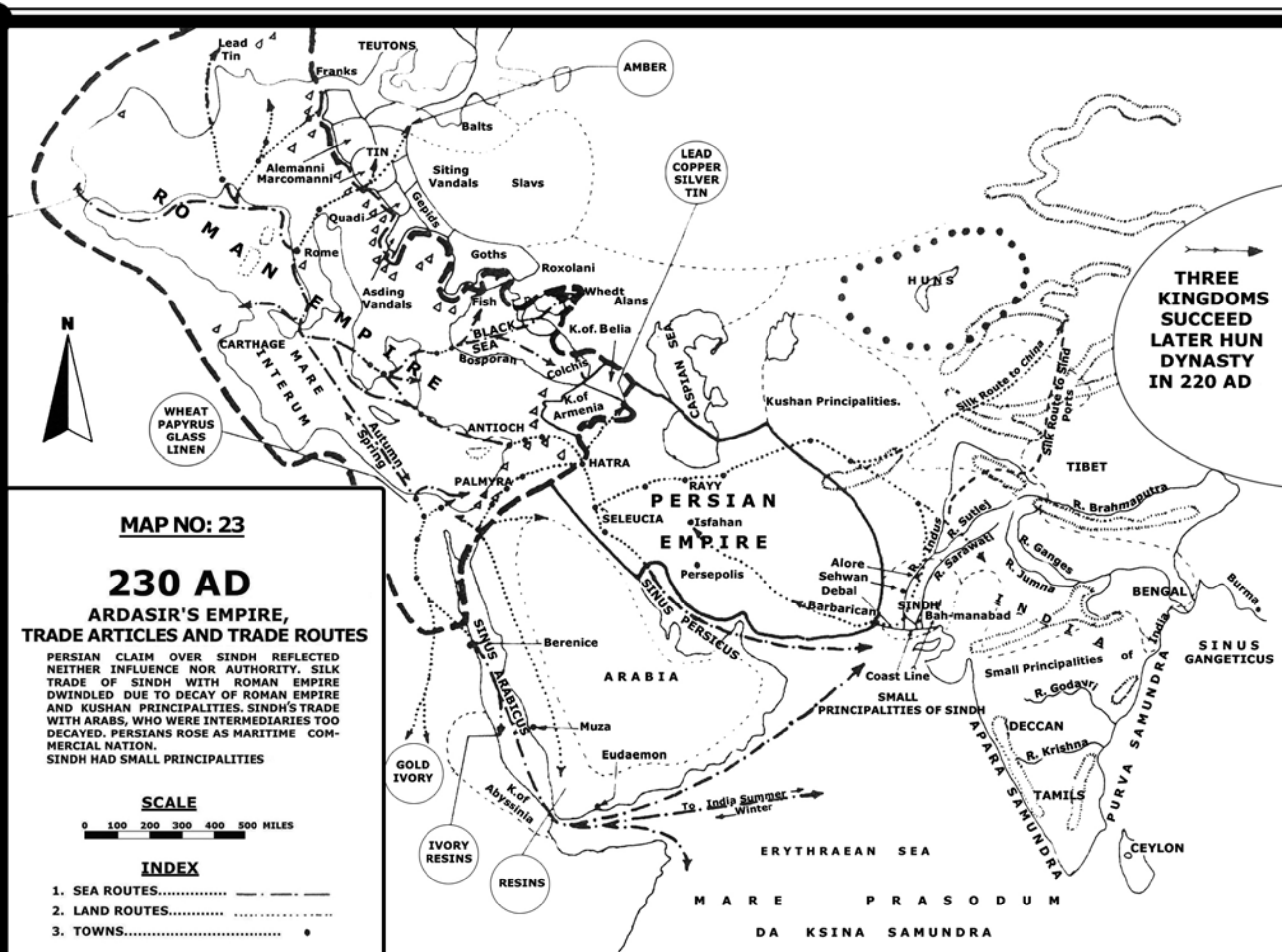


MAJOR CHANGES IN COURSES OF THE RIVER INDUS, WHICH DESTROYED 50% IRRIGATED AREA AND REDUCED POPULATION TO HALF

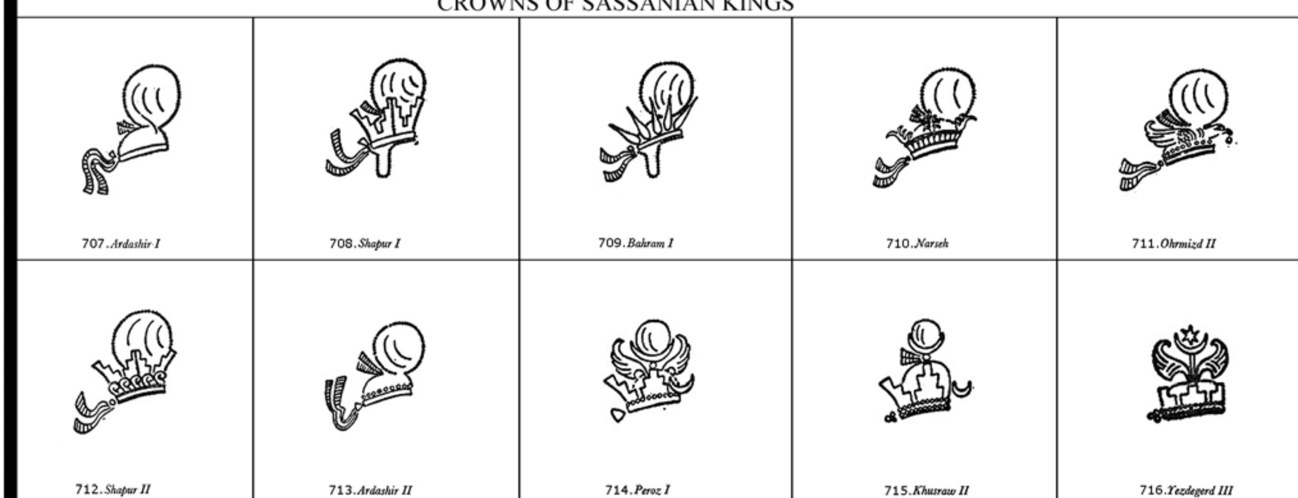
MAP NO: 19	MAP NO: 20	MAP NO: 21	MAP NO: 22
NARA, SAMARO, PURAN, SHAHDADPUR AND NASARPUR COURSES, OF THE RIVER INDUS IN THE CENTRAL SINDH ON LEFT BANK IN 7TH - 13TH CENTURIES	BULRI, GUNGRO, GOLARCHI AND AHMED RAJO COURSES OF THE RIVER INDUS IN LOWER SINDH ON THE LEFT BANK IN 10TH-14TH CENTURIES	KALRI, BAGHAR, RICHHAL AND OCHTO COURSES OF THE RIVER INDUS ON THE RIGHT BANK IN 10TH-18TH CENTURIES	1250-1750 AD, COURSES OF THE RIVER INDUS IN SOUTHERN SINDH

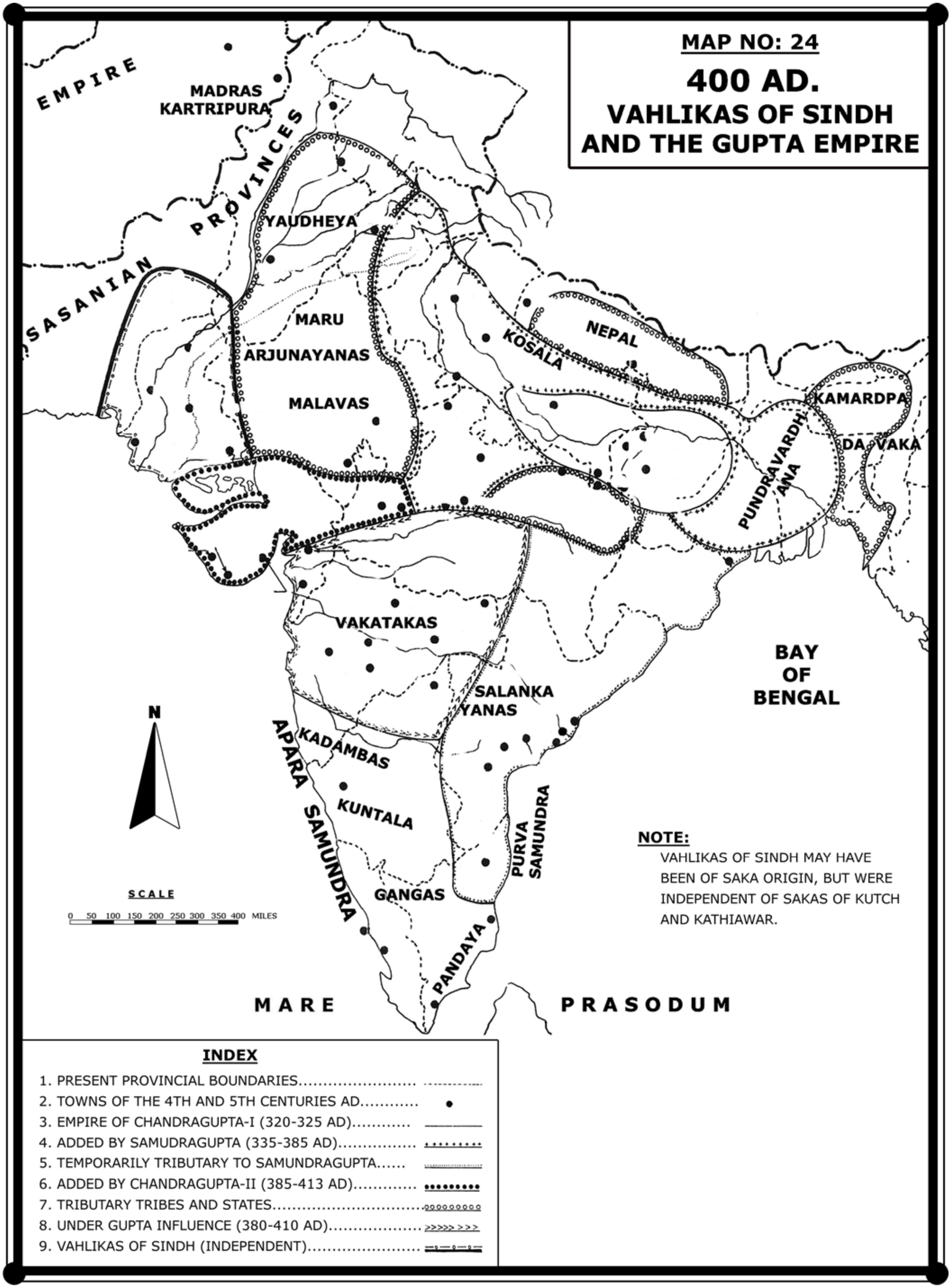
bark of some trees and treatment of natural dyes with alum and other chemicals. Sindh and the southern Punjab also produced madder and indigo, which were processed to produce fast colours. The sixth century chemical treatise Brihat-Samhita by Varahmihira describes many such chemical processes.

Nothing is known about irrigation during this period. Information on agriculture and position of the river is lacking. Persians dominated the navigation in the Arabian Sea and the western coast of the India. Persian Jews settled in Debal in third century AD and carried trade in the produce of Sindh to Iran and westwards to the Roman Empire. There is lack of information on the produce and trade.



CROWNS OF SASSANIAN KINGS




MAP NO: 24
400 AD.
VAHLIKAS OF SINDH
AND THE GUPTA EMPIRE
EMPIRE
MADRAS
KARTRIPURA
PROVINCES
SASANIAN
YAUDHEYA
MARU
ARJUNAYANAS
MALAVAS
KOSALA
NEPAL
KAMARDPA
DA VAKA
PUNDRAVARDH ANA
VAKATAKAS
SALANKA YANAS
BAY OF BENGAL
N
APARA SAMUNDRA
KADAMBAS
KUNTALA
GANGAS
PURVA SAMUNDRA
PANDAYA
SCALE
0 50 100 150 200 250 300 350 400 MILES
NOTE:
VAHLIKAS OF SINDH MAY HAVE BEEN OF SAKA ORIGIN, BUT WERE INDEPENDENT OF SAKAS OF KUTCH AND KATHIAWAR.
MARE
PRASODUM
INDEX
1. PRESENT PROVINCIAL BOUNDARIES........................
2. TOWNS OF THE 4TH AND 5TH CENTURIES AD............
3. EMPIRE OF CHANDRAGUPTA-I (320-325 AD)............
4. ADDED BY SAMUDRAGUPTA (335-385 AD)................
5. TEMPORARILY TRIBUTARY TO SAMUNDRAGUPTA......
6. ADDED BY CHANDRAGUPTA-II (385-413 AD).............
7. TRIBUTARY TRIBES AND STATES..............................
8. UNDER GUPTA INFLUENCE (380-410 AD)...................
9. VAHLIKAS OF SINDH (INDEPENDENT).......................

CHAPTER 19

IRRIGATION UNDER VAHLIKA DYNASTY OF SINDH; PROBABLY 356 - 415 AD AND LOCAL PRINCIPALITIES UP TO 500 AD

Vahlikas ruled Sindh and were contemporaries of Chandragupta-II who ruled for 40 years from 375-415 AD. At that time Sakas (Scythians) were ruling Gujarat, Kutch and Kathiawar, which areas were subdued and annexed by Chandragupta-II in 395 AD. He is reported to have been opposed to Vahlikas of Sindh and crossed seven mouths of the Indus to subdue them, but did not conquer the capital, which was either at Alore or Brahmanabad. This may simply have been a raid on the lower Sindh. Since his major campaigns were fought against Sakas or Scythians between 388-409 AD this raid may have taken place around 405 AD. Hitherto it was thought that Sindh came under western satrapies or Sakas of Malwa. This is disproved by above incident.

The exact date of Vahlikas coming into power as well as the end of their rule cannot be ascertained. Probably they rose in 356/57 AD after Sassanids lost control over Sindh. The Persian hold over Sindh was for brief period during about 283-356 AD. Vahlikas may have been successors of their governors or satrapies and may have become independent. They may have ruled up to 500 AD when Rai dynasty replaced them. There is also a conjecture that they may have been displaced by Huns who may have conquered Sindh in 465 to 475 AD and the Hun governors then may have ruled Sindh up to 500 AD.

The Hun's rule of Sindh is doubted by most authorities as Huns had embraced Hinduism and were so fanatical that they would not have allowed Buddhism to survive in Sindh.

The Hun invasion from the eastern areas of the Central Asia was caused by their movement in the beginning of fifth century AD due to severe drought conditions. They destroyed the Gupta Empire. Under their pressure many tribes of Rajasthan fled and were replaced by new tribes who became the ancestors of some of Rajput families and again were to dominate the history of northern parts of South Asia in later centuries. These Rajputs subsequently called themselves Khatris or the warriors though they were not genuine Khatris of the Vedas.

Salaries to the high officials were not paid in cash but in grants of land on the pattern introduced by Sassanids and Guptas. This was beginning of Jagirdari, which started with Sassanids in 283 AD, but they controlled Sindh only for 75 years and Guptas did not rule Sindh. Presence of Bhaiyat among Jareja Samma rulers of Kutch (1148-1948 AD), who had migrated from Sindh shows that Jagirdari had no roots in Sindh until the Mughal rule of Sindh.

TRADE

Guilds were developed all over the South Asia as major institutions for manufacture of goods for commercial enterprises by Guptas and these must have been introduced in Sindh. Manufacture of textiles of various kinds was the major industry of Sindh. Some silk also came from China to Sindh via the Indus silk route though until the Hun invasions the silk route through the Central Asia carried major part of the trade of this item. Lapis lazuli also was imported in Sindh from Badakhshan for re-export. Besides rice, indigo and madder of Sindh and the Punjab, textiles, sugar and herbs also remained main items of export from the Sindh’s port of Barbarican, which was named as Debal probably in the fifth century AD due to presence of Jewish synagogue or Deval. During the rule of Vahlikas indigo and cotton remained main items of export from Sindh.

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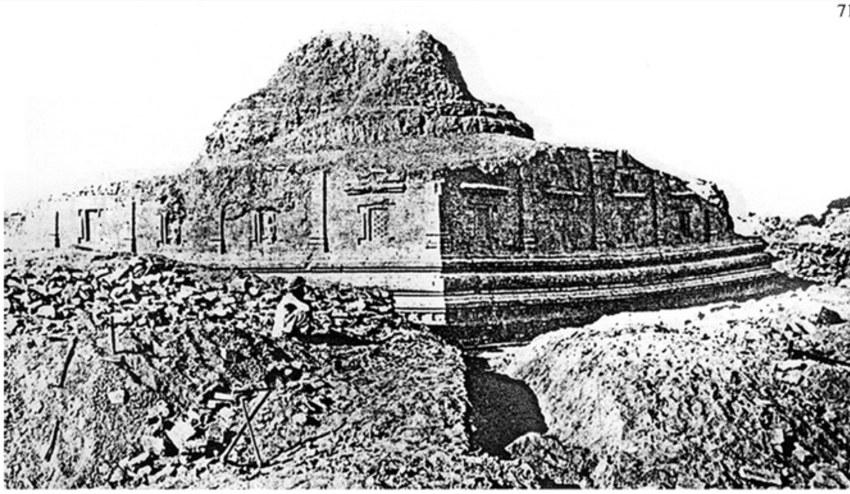

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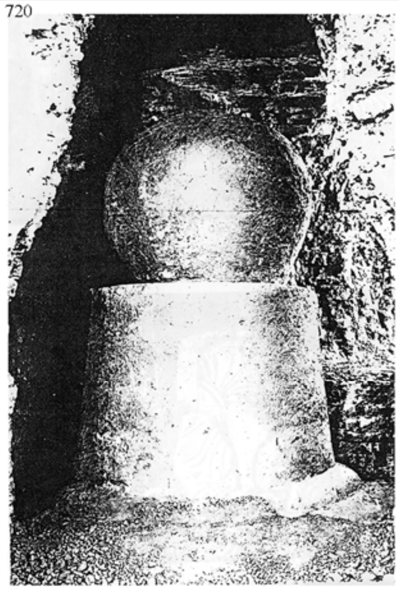

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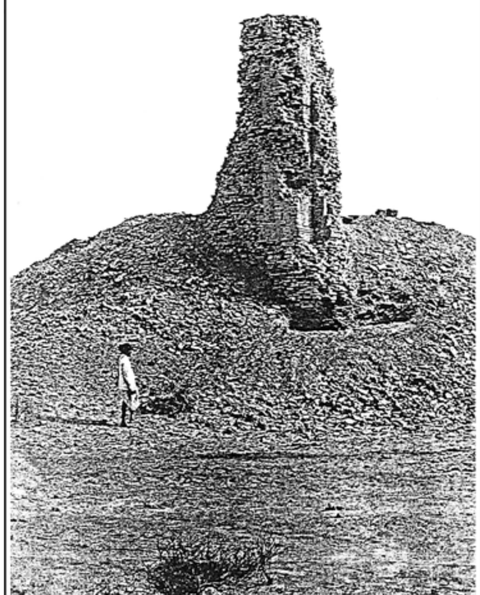

RELIGIOUS STRUCTURES

717. Mirpurkhas stupa after excavation by Cousens.
718. Thul Mir Rukan, 600 AD.
719. Saidpur stupa or Sudheranjo Daro. (Arch. Sur. Ind. 1918 AD.)
720. Dagoba or Holt relic holder, 6 feet 9 inches tall, of sun dried bricks was the original Buddhist structure, which later on was encased in Sudheranjo-daro in ASI, 1918.
721. Brahmanabad tower or Thul. Actually Buddhist stupa, photographed around 1900 AD.
722. Inner pillar at Thul Mir Rukan and dails of floral mouldings.

WARM WET PERIOD AND BUDDHIST GLORY (400 - 700 AD)

From 400-700 AD it became warm and the country became prosperous. We have the records, which show that the Vahlika rulers of Sindh repelled Chandragupta-II; Rai Seharas-II defeated Persian army in Makran in 600 AD though he himself was killed; Rai Sehasi-II repelled Harasha between 620-630 AD and Brahmans under Dahar repelled fourteen attacks of Arabs. Almost all major Buddhist stupas have been built during these three hundred years of Sindh's prosperity brought by favourable climate discussed in Chronological Dictionary of Sindh.

Though information on irrigation during the period is lacking, but indirect information shows that the country was prosperous and the king was strong. The strength of Sindh's king could only come from well-irrigated agriculture. This information comes from Mehrauli iron pillar inscription.

Recent studies show that many stupas in Sindh were constructed or renovated in the fourth to seventh centuries instead of second and third centuries hitherto believed. This applied to the classical religious architecture. Art develops only in long standing peace and prosperity. In case of Sindh it would be the outcome of stable course of the River Indus possibly for at least a couple of centuries. Map six shows the courses of the River Indus and towns on it for this period. Large number of towns indicates the surplus of agricultural commodities, which in turn leads to urban development.

During the end of direct trade with the west (Roman Empire) new trading areas were opened up in south-east Asia. In this Sindh had no direct share, but exported its products to the south Indian ports for onward transmission.

The Persians became sole middlemen for Sindh as well as the South Asia's trade with the West. Most of them were Jews. A Jew merchants' colony was established at Barbarican (Banbhore or Debal).

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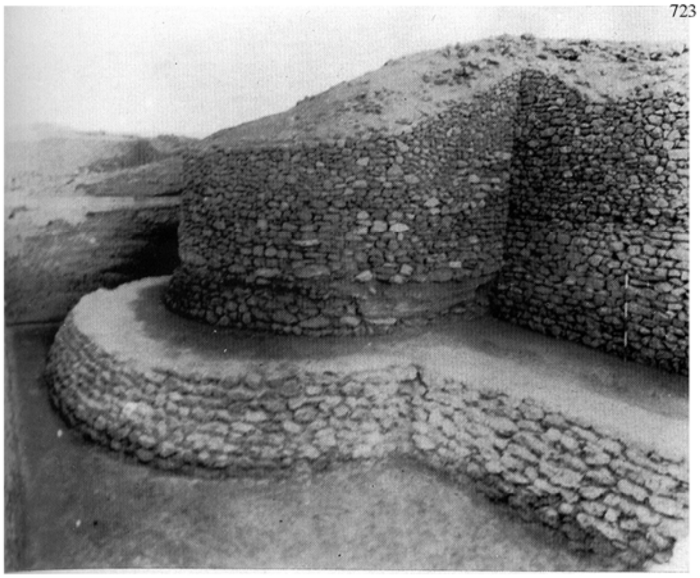

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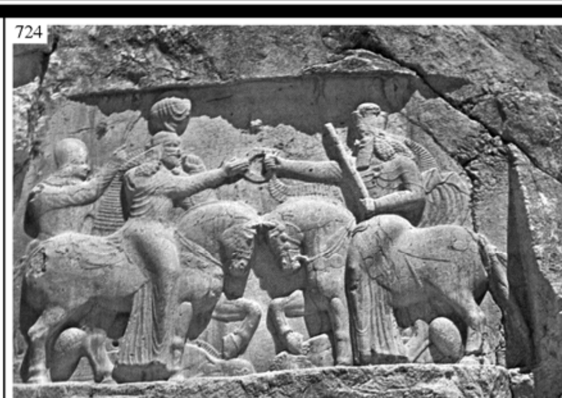

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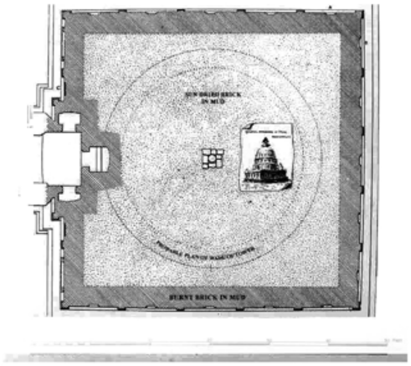
BANBHOR CITADEL, NAQSH-I RUSTAM AND ALORE

723. Banbhore (Debal) citadel fortification.
724. Rock relief at Naqsh-i Rustam depicting the investiture of Ardashir I (224-241 AD).
725. Ruins of Alore or Aror fort and towership. (Pakistan Archaelogy No.1, 1965).
726. The north-eastern gate, Banbhore.

RELIGIOUS STRUCTURES AND OBJECTS

727



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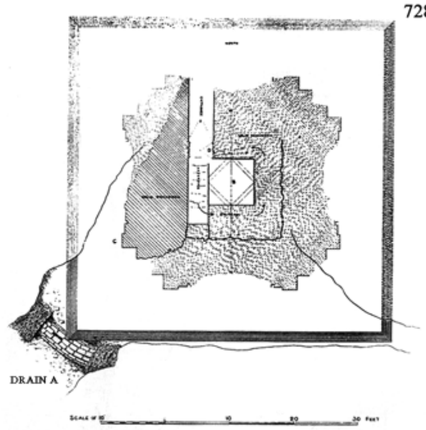

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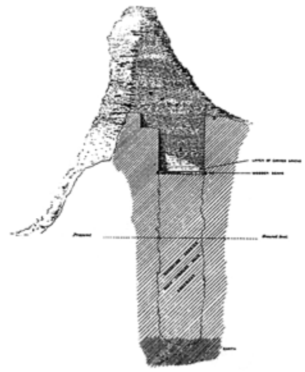

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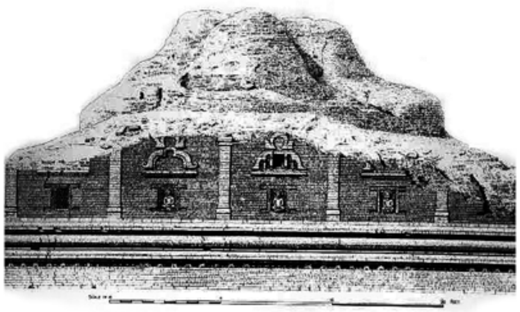

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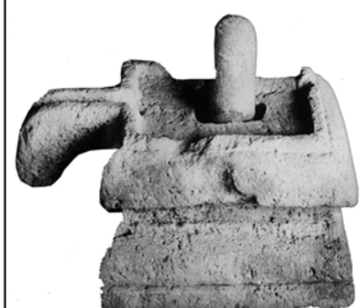

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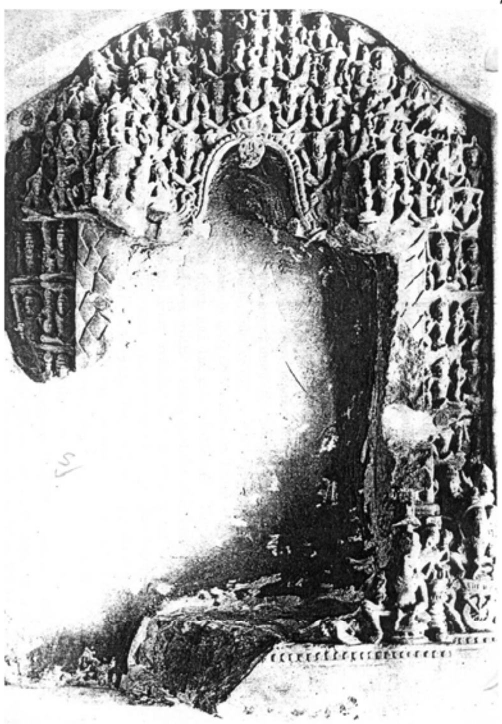

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727. Plan of the stupa at Mirpurkhas, 600 AD.
728. Plan of Thul.
729. Section of Thul, on line A-B looking west.
730. Elevation of the stupa at Mirpurkhas, 600 AD
731. Yoni and Lingam was deity of Hindu religion. This was found from Banbhore temple on the site of which mosque was constructed, 5th – 8th century AD.
732. Elevation of west face of Thul.
733. Frame of an image from Brahmanabad.
734. Stupa at Mirpukhas, 600 AD.
735. Section of drain A.
736. The Thuk at Depar Ghangro.

CHAPTER 20

IRRIGATION UNDER RAI DYNASTY; 500 - 641 AD

According to Chachnama Rai dynasty ruled Sindh for one-hundred-and-thirty-seven lunar years up to 632 AD, but as South Asians added a leap month every three years the solar years could be one-hundred-thirty-three from start of dynasty around 500 AD. As Hieun Tswang saw a Sudra king ruling in 640/41 AD Rai Sehasi-II may have ruled up to 641 AD.

The following were Rai dynasty rulers of Sindh:

1.	Rai Dewaji	500 – 641 AD
2.	Rai Seharas-I	
3.	Rai Sehasi-I	
4.	Rai Seharas-II	
5.	Rai Sehasi-II	

Around 600 AD King Seharas-II lost his life in a battle with Sassanid governor (called king of Nimruz or Sijistan) in Makran. The Sassanid army was however defeated and routed. His son Rai Sehasi-II succeeded his father. The Sassanids may consequently have occupied Multan for some time.

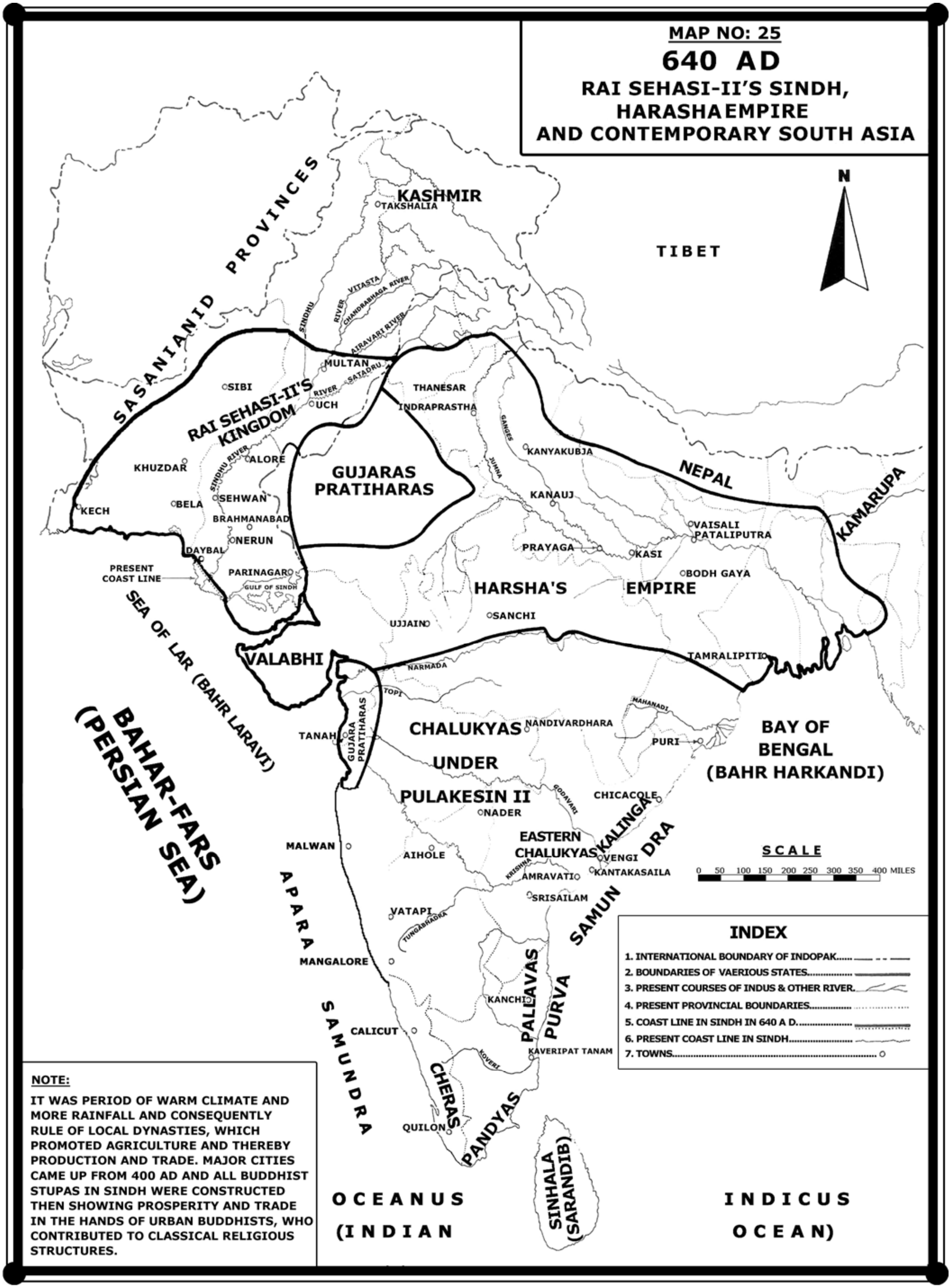
Hieun Tswang considers Rais as Sudras and Chachnama mentions them of Rajput origin from Chitor. Since the decline of Kushans the war like aristocracy of Bactrians, Scythians, Kushans, Parthians and Yue-chi mingled with the local war like aristocracy both culturally and by blood. The off-springs calling themselves Rajputs (sons of Rajas) or Khatris worshipped Hindu deities and asserted for power in Rajputana, Sindh, Gujarat and Kathiawar. The Rais may have been typical of this type, but being Buddhists were probably called Sudras in the Hindu kingdoms of the South Asia or they may have been locals and therefore called Sudras by Rajputs.

Rai Sehasi-II conquered Larkana (Persian Makran) between 630 and 640 AD from Sassanians. Arabs occupied it between about 680-700 AD. Brahman rulers of Sindh made no attempt to recover this territory as it was scarcely populated, economically poor and would not have yielded significant returns. Rai Sehasi also conquered Kaikanan (Khuzdar) in 641 AD. Schwartzberg puts it as Quetta, Zhob and Loralai districts. This is possible as Sassanids were defeated by Arabs under Khalifa Umar in 634 AD and in confusion prevailing Sindh extended its borders in territories previously belonging to the Sassanid emperor Yazdegird bin Shaharyar bin Pervez.

The contemporary of Rai Sehasi-II of Sindh was Harasha. Gujara Pratiharas ruled present Rajasthan. Raja Ramal ruled Chitor. Harasha with his capital at Kanuj ruled whole of northern India i.e., UP, Bihar, Haryana etc. The northern Punjab was ruled by Shahis.

The kingdom of Sindh consisted of four divisions namely:

1. Brahmanabad; consisting of the lower Sindh and the island of Kutch with capital at Brahmanabad - later on renamed as Mansura by Arabs.
2. Siwistan; consisting of south-western Sindh (it included the whole of Karachi, Dadu, parts of Lasbella district and also parts of Kambar taluka) with capital at Sehwan.
3. Alore (called Iskanda by Chachnama); consisting of present Khairpur, Sukkur, Jacobabad, Shikarpur and Rahim Yar Khan districts up to Uch and also Sibi-Kachhi and Jhalawan districts.
4. Multan; consisting of Multan, Muzaffargarh, D.G. Khan, Khanewal and Bahawalpur districts. Multan may have been lost to the Persians at least temporarily for some time between 610-620 AD as Khusru Pervez stamped silver and gold coins at Multan during the period. Probably on account of these differences when Roman emperor Hercules (610-641 AD) defeated Khusru Pervez in 617 AD the king of Sindh (Rai Sehasi-II) sent his ambassador with congratulatory messages to


MAP NO: 25
640 AD
RAI SEHASI-II'S SINDH,
HARASHA EMPIRE
AND CONTEMPORARY SOUTH ASIA
N
KASHMIR
TAKSHALIA
TIBET
SASANIANID PROVINCES
SINDHU RIVER
VITASTA
CHANDRABHAGA RIVER
AIRAVATI RIVER
MULTAN
SATADRU RIVER
SIBI
RAI SEHASI-II'S KINGDOM
UCH
THANESAR
INDRAPRASTHA
GANGES
JUMNA
KANYAKUBJA
ALORE
GUJARAS PRATIHARAS
KHUZDAR
SINDHU RIVER
NEPAL
KAMARUPA
KANAUJ
KECH
BELA
SEHWAN
BRAHMANABAD
NERUN
DAYBAL
VAISALI
PATALIPUTRA
PRAYAGA
KASI
PRESENT COAST LINE
PARINAGAR
GULF OF SINDH
BODH GAYA
HARSHA'S EMPIRE
SEA OF LAR (BAHR LARAVI)
UJJAIN
SANCHI
VALABHI
TAMRALIPITI
NARMADA
TOPI
MAHANADI
BAHAR-FARS (PERSIAN SEA)
TANAH
GUJARA PRATIHARAS
CHALUKYAS UNDER PULAKESIN II
NANDIVARDHARA
PURI
BAY OF BENGAL (BAHR HARKANDI)
GODAVARI
CHICACOLE
NADER
KALINGA
EASTERN CHALUKYAS
MALWAN
AIHOLE
VENGI
KRISHNA
AMRAVATI
KANTAKASAILA
SAMUNDRA
SCALE
0 50 100 150 200 250 300 350 400 MILES
APARA
SRISAILAM
VATAPI
TUNGABHADRA
SAMUN
MANGALORE
PALLAVAS
PURVA
KANCHI
INDEX
1. INTERNATIONAL BOUNDARY OF INDOPAK
2. BOUNDARIES OF VAERIOUS STATES
3. PRESENT COURSES OF INDUS & OTHER RIVER
4. PRESENT PROVINCIAL BOUNDARIES
5. COAST LINE IN SINDH IN 640 A D.
6. PRESENT COAST LINE IN SINDH
7. TOWNS
SAMUNDRA
CALICUT
KAVERI
KAVERIPAT TANAM
CHERAS
PANDYAS
QUILON
SINHALA (SARANDIB)
OCEANUS (INDIAN
INDICUS OCEAN)
NOTE:
IT WAS PERIOD OF WARM CLIMATE AND MORE RAINFALL AND CONSEQUENTLY RULE OF LOCAL DYNASTIES, WHICH PROMOTED AGRICULTURE AND THEREBY PRODUCTION AND TRADE. MAJOR CITIES CAME UP FROM 400 AD AND ALL BUDDHIST STUPAS IN SINDH WERE CONSTRUCTED THEN SHOWING PROSPERITY AND TRADE IN THE HANDS OF URBAN BUDDHISTS, WHO CONTRIBUTED TO CLASSICAL RELIGIOUS STRUCTURES.

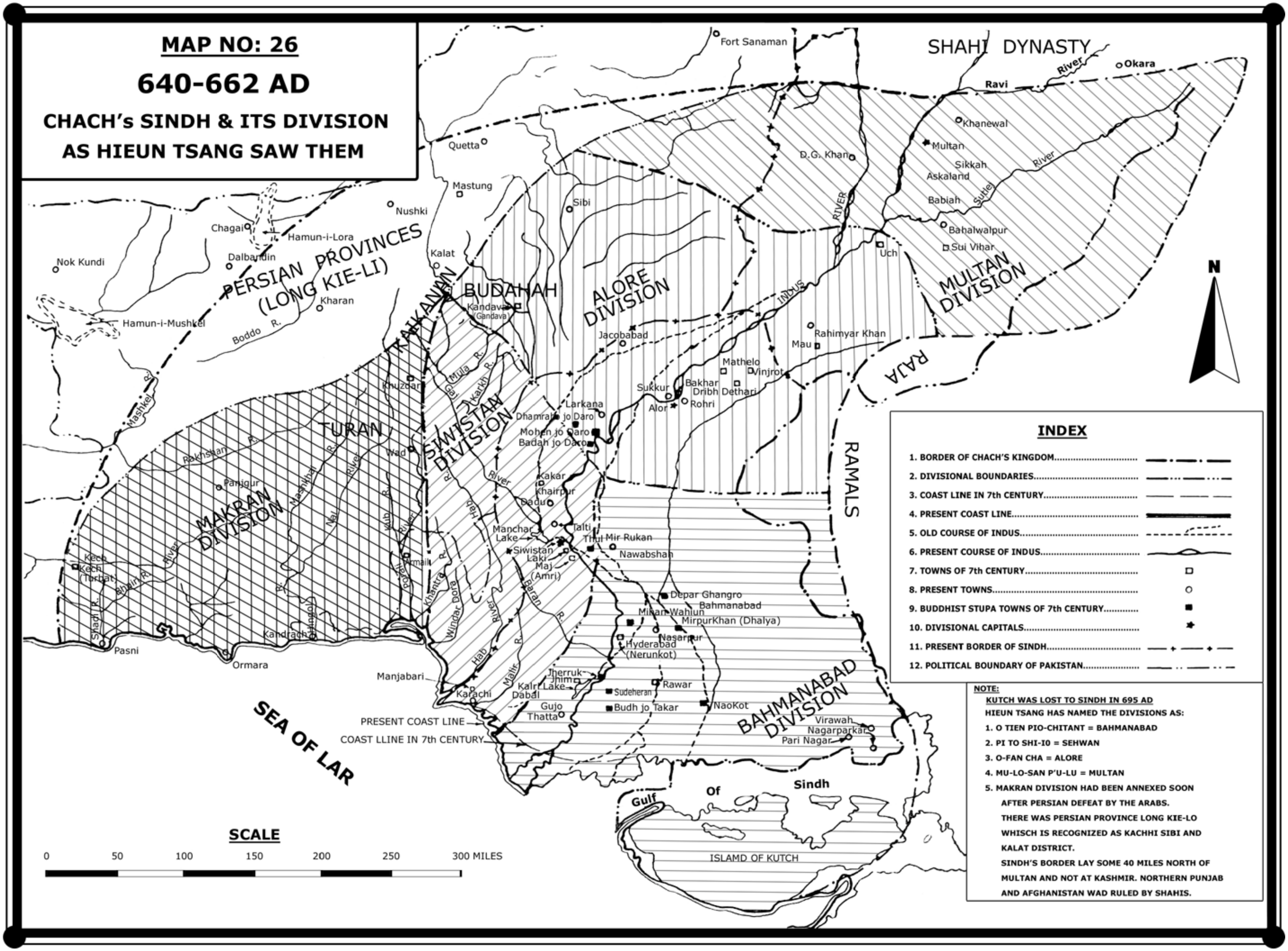
Constantinople. The differences may also have been caused by governor of Nimruz's attack on Sindh in 600 AD when Rai Seharas-I lost his life.

Probably somewhere in mid-seventh century the Chinese invented the horse collar enabling the animal to pull from the shoulders and not restrict its own wind-pipe. This was quickly adopted the world over. No such collar has been popular for oxen though it can increase draft capacity of animal substantially. Bullock collar was designed by the present writer at Tando Jam Agriculture Workshop in mid-sixties, but soon tractors started replacing bullocks and collar became redundant before it could be popularised. Lack of collar affected draft capacity of bullocks by one third to half, which means farmers could cultivate proportionately less land with a pair of bullocks. This inefficiency has led to poverty among the farmers who at times accounted for more than eighty percent of population.

For the warm climate and more rain fall from 400-700 AD (refer last chapter) it has been stated that in an arid but irrigated country the religion invariably places itself within the authority of the government. The despotic rulers and their officials either adopt the religion of masses or forcibly convert them. Only by this method the masses are prevented from organising and utilising native religion to oppose the state. The rule of Rai dynasty is considered peaceful and people are known to be prosperous. At the time of Chach's succession to the last Rai of that dynasty all the six governors of Sehasi-II in Sindh were Buddhists. One of them a monk posted in Budhiya country the other at Agham (Aghamani) and third at Armail (Lasbella) were continued in their position by Chach who himself was a Brahman. This was the easiest way to please the masses majority of whom were Buddhists. The country reported to be prosperous was due to well managed irrigated agriculture. Since peace prevailed in Sindh during this century-and-half the irrigation system must have covered a vast area giving rise to large population. As discussed under Vahlikas the fourth to seventh centuries was the period of construction of large number of stupas having classical architecture. This is indirect evidence of prosperity on account of efficient irrigation, stable position of the River Indus and foreign trade.

Though majority of Sindhis were Buddhists they were mostly agriculturists; cultivating land and raising cattle. They killed animals and ate beef and meat. Their priests numbering tens of thousands did no work and though dressed like Bikshus were dishonest and luxuriant. During the whole period of Rai dynasty's rule Buddhism was on the decline.

Under Guptas cow-slaughter was banned in India. Sindh had vast pasture-lands. More than half of farmers' income was from animal raising. Meat was part of the food of the Sindhis. Buddhism had allowed partaking meat if the eater had not participated in killing the animal. A low caste of butchers was created to overcome the formal obstacle. The economy did not allow giving up meat specially beef and therefore acceptance of Brahmanism. Sindhis therefore chose to remain Buddhists whose monks overlooked their meat eating. Rais were firm believers of Buddhism and patronised the religion. Thul Mir Rukan and Dhaliya (Kahujo Daro) stupas must have been important Buddhist shrines of the period. These were built during their rule. Some additions and repairs were carried out to both of them during ninth to twelfth centuries AD. Monastery at Mohenjo Daro continued to exist in the sixth century AD. It is possible that stupas at Jhukar, Dhamrahojo Daro, Nerunkot, Sudheranjo Daro, Sehwan, Debal, Budhjo Takar, Jherruck and Naukot also were flourishing during their rule. The other possible sites of stupas would be Bubak, Arazi, Bakhtiarpur and Talti, which villages probably stand on the top mud stupas. During the period trade between Sindh and the West was mostly by sea. The trade routes connected Debal (Barbarican) with Cteziphon on the Tigris via Persian Gulf and with Alexandria via Aden, Red Sea and Bernice. From Alexandria goods could go to Carthage in Algeria, Rome, Milan, Constantinople and etc. Sindh exported a few true spices. Definition of spices during the period included dyes, sugar, indigo, scents, pigments, gums incense, medical plants, minerals, mordents etc, of which Sindh must have exported some. Textile, sugar, cotton and indigo were its main items of export. Chinese silk and furs, Tibetan skins and furs and Himalayan musk must have been shipped from Debal (Barbarican - renamed as Deval after Persian Jews' synagogue). Roman emperor Justinian had made attempts to find alternative routes as Sassanians had stronghold on silk route via Rayy and Hamdan. Arabs still acted as middlemen between Roman Empire and the South Asia. By 550 AD Romans were able to obtain from China silk worms by stealth and put them to work thus reducing China silk trade. Hieun Tswang a Chinese monk whose "Travels" have survived mentions rice, wheat, millet, cereals, flowers, fruits and grains of different kinds grown in the region.


MAP NO: 26
640-662 AD
CHACH's SINDH & ITS DIVISION
AS HIEUN TSANG SAW THEM
SHAHI DYNASTY
MULTAN DIVISION
ALORE DIVISION
BUDAHAH
KAIKANAN
SIWISTAN DIVISION
MAKRAN DIVISION
TURAN
PERSIAN PROVINCES (LONG KIE-LI)
BAHMANABAD DIVISION
RAJA
RAMALS
SEA OF LAR
Gulf Of Sindh
ISLAMD OF KUTCH
Fort Sanaman
Okara
Ravi
River
Khanewal
Multan
Sikkah
Askaland
Babiah
Sutlej
Bahalwalpur
Sui Vihar
Uch
D.G. Khan
RIVER
INDUS
Rahimyar Khan
Mau
Mathelo
Vinjrot
Bakhar
Dribh Dethari
Sukkur
Alor
Rohri
Quetta
Mastung
Nushki
Sibi
Jacobabad
Chagai
Hamun-i-Lora
Dalbandin
Nok Kundi
Kalat
Kharan
Hamun-i-Mushkel
Boddo R.
Mashkel
Kandava (Gandava)
Mula R.
Karkh R.
Khuzdar
Larkana
Dhamrah jo Daro
Mohen jo Daro
Badah jo Daro
Wad
Rakhshan R.
Panjgur
Kakar
Khairpur
Dadu
Manchar Lake
Talti
Thul Mir Rukan
Nawabshah
Siwistan
Laki
Maj (Amri)
Ormali
Kech Kech (Turbat)
Shadi R.
Pasni
Ormara
Kandrach
Hab
Baran R.
Windar Dora
Khantra R.
Depar Ghangro
Bahmanabad
Mihan Wahlun
MirpurKhan (Dhalya)
Nasarpur
Hyderabad (Nerunkot)
Manjabari
Jherruk
Jhim
Kalri Lake
Dabal
Karachi
Gujo
Thatta
Sudeheran
Budh jo Takar
Rawar
NaoKot
Virawah
Nagarparkar
Pari Nagar
PRESENT COAST LINE
COAST LLINE IN 7th CENTURY
N
SCALE
0 50 100 150 200 250 300 MILES
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1. BORDER OF CHACH'S KINGDOM
2. DIVISIONAL BOUNDARIES
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8. PRESENT TOWNS
9. BUDDHIST STUPA TOWNS OF 7th CENTURY
10. DIVISIONAL CAPITALS
11. PRESENT BORDER OF SINDH
12. POLITICAL BOUNDARY OF PAKISTAN
NOTE:
KUTCH WAS LOST TO SINDH IN 695 AD
HIEUN TSANG HAS NAMED THE DIVISIONS AS:
1. O TIEN PIO-CHITANT = BAHMANABAD
2. PI TO SHI-IO = SEHWAN
3. O-FAN CHA = ALORE
4. MU-LO-SAN P'U-LU = MULTAN
5. MAKRAN DIVISION HAD BEEN ANNEXED SOON AFTER PERSIAN DEFEAT BY THE ARABS.
THERE WAS PERSIAN PROVINCE LONG KIE-LO WHISCH IS RECOGNIZED AS KACHHI SIBI AND KALAT DISTRICT.
SINDH'S BORDER LAY SOME 40 MILES NORTH OF MULTAN AND NOT AT KASHMIR. NORTHERN PUNJAB AND AFGHANISTAN WAD RULED BY SHAHIS.

CHAPTER 21

IRRIGATION UNDER BRAHHMAN DYNASTY WHOLE SINDH; 641 - 712 AD AND EASTERN SINDH; 715 - 725 AD

The founder of the dynasty was Chach who usurped the throne on the death of Rai Sehasi-II with the active help of Soohan Devi the Queen of deceased king whom he married. Rana Mahrat the ruler of Chitor and kinsman of Sehasi hearing of his death, treacherous killing of all his heirs and relatives and usurping of the throne by Chach invaded Sindh, but was killed in a single combat. Shortly after his accession at Alore all other four provinces of his kingdom namely; Multan, Iskanda (Uch), Sistan and Brahmanabad declared independence, but he subdued them all. He also added to his kingdom Makran, Kaikan (Kalat) and Gandava (Sibi and Kachhi), which probably were part of Persian Empire since annexation of Multan between 610 and 627 AD by the Sassanians to their domain and conquered by Rai Sehasi-II between 630-640 AD.

The rulers of this dynasty were:

1.	Chach Bin Selaj	641 – 662 AD
2.	Chandur Bin Selaj	662 – 669 AD
3.	Dahar Bin Chach (the upper Sindh)*****	669 – 712 AD
4.	Duraj Bin Chach (the lower Sindh)******	669 – 670 AD
5.	Dhaharsia Bin Chandur (the lower Sindh)	670 – 700 AD
6.	Dahar Bin Chach (the whole Sindh)	700 – 712 AD
7.	Jasina Bin Dahar (the eastern Sindh)*******	715 – 725 AD

* Upper Sindh consisted of Alore, Uch, Multan, Bolan, Sibi and Kachhi.

** Lower Sindh consisted of Brahmanabad, Sehwan, western Sindh, Lasbella, Makran and Kutch, which were captured by Chawras between 685-695 AD, but neither Dhaharsia nor Dahar attempted to recapture them.

*** Eastern Sindh consisted of all area east of the Indus, which then flowed through the present alignment of Rohri Canal to Shahdadpur and Brahmanabad to Sir Creek.

The Brahman dynasty started well under its founder Chach, but after the death of Chandur his brother and successor in 669 AD things seem to have deteriorated due to some changes in the course of River Indus in the lower Sindh disturbing the economic life and creating chaotic conditions. Sindh had been divided in 669 AD; the upper Sindh going to Dahar and the lower Sindh to his cousin Dhaharsia bin Chandur. After the latter’s death in 700 AD Dahar ruled the whole Sindh. There is a report of mass migration of leading and populous Kathia tribe of Sindh to Kutch and from thence to Kathiawar to which they gave their name. The en-block migration of such a big community could only be due to a major change in the course of river Indus abandoning its old channel and causing thereby destruction of the irrigation system. As a consequence of this change Dhaharsia and Dahar lost control over the lower Sindh. There is a conjecture that by this time water in Hakra had also reduced considerably affecting Kharif irrigation. From 700-900 AD was dry period the world over. Onset of dry weather and change of the course of River Indus is discussed in next chapter.

In 711 AD Arabs marched unhindered through the lower Sindh. Their boats carrying war machines; catapults and machines for scaling walls were sent by sea via the Indus up to the vicinity of Aghamkot (Aghamani). This indicates lack of habitation in the deltaic area and absence of canal works. Dahar then allowed Arabs to conquer the equally sparsely

BUDDHIST ARTISTIC TILES AND BRICKS USED IN KAHUJO DARO AND SUDHERANJO DARO


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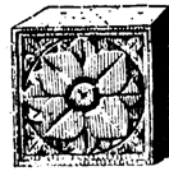
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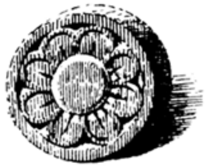
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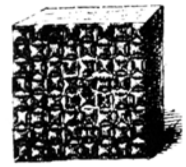
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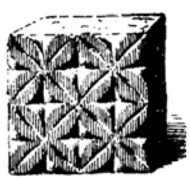
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Buddhist used die-cast bricks in their stupas in SIndh during sixth and seventh centuries.Most of them were floral and a few depicting dieties. Figures on this page show various types of flowers. Interestingly ornaments of the era have similar designs and tiles have the same delicacy as ornaments. Soomra tiles designs have evolved from Buddhist Some of designs were later on adopted in Delhi Sultanate and Mughal architecture. Geometrical patterns of Egyptian, Greek, Celtic, Buddhist and Islamic art have evolved gradually and have been influenced by their predecessors. It is not certain whether Soomras used these tiles in religious or secular buildings. (Cousens).

populated right bank of the River Indus up to Sehwan without opposition. The failure of irrigation system thus may have been the main cause of Dahar's down fall as otherwise the Brahman dynasty had successfully repelled fourteen expeditions of Arabs between 642 and 709 AD - the respective years being 642, 658, 663, 665, 667, 668, 694, 704 and 709 AD.

In the opinion of the present writer this change in the river may have been from the eastern Puran to the western Puran as no city of any importance existed at the time of Arab conquest in the region. In the rest of Sindh urban life subsisting on surplus irrigated agricultural commodities was well established and major towns of following names are reported: Uch, Mau, Mathelo, Vinjrot, Dribh Dethari, Dihat, Dhamraho, Badah, Thul Mir Rukan, Depar Ghanghro, Mian Wahiyu, Dhaliya (Mirpurkhas), Rawar, Budhjo Takar, Nerunkot, Sudheran, Jherruck, Gujo, Naukot, Pir Patho, Kafirkot, Sehwan, Talti, Kakar, Khanpur, Laki, Amri and Debal - shown in maps.

It is therefore concluded that during the seventh century irrigation was well established and managed, but some changes in the course of the River Indus in the lower Sindh at the end of the century i.e., around 700 AD caused ruination of the irrigation system thereby putting some area out of cultivation. The loss is difficult to estimate, but must have been considerable and it brought the end of Brahman dynasty. In addition to hydrological changes in the River Indus onset of aridity reduced animal carrying capacity of Thar and Kohistan and thereby even population in that area.

The Nara-Hakra river system was non-perennial but active then on spill waters from the Sutlej in Bahawalpur and the Indus in Ghotki district though only for a month. The Hakra divided itself into two channels near the present Jamrao Head. The western channel flowed near Brahmanabad where an eastern branch of Indus too joined it. The soils of the area show that this bifurcation may have been a permanent feature of Nara-Hakra for centuries. The coastline must have been some ten to fifteen miles inland than at present. The Indus divided itself had three branches: one the western passing between Sultankot and Jacobabad to Manchar Lake; the other and the main branch through Lohano Dhoro and; the third passed through Alore gorge and met Lohano Dhoro near Khairpur Mir's. Possibly the change in the course of River Indus from the eastern Puran to the western Puran was during the rule of Dhaharsia (670-700 AD). Similar hydrological changes resulted in economic difficulties in the lower Sindh where only a few cities of importance were left out.

It was also that time that Buddhism started losing to Hinduism and soon afterwards to Islam. The rulers were tolerant of Buddhism, but the Buddhist elite knew that slowly they will be absorbed into Hinduism. Chandur (662-669 AD) was impressed by Buddhist teachings and had appointed Buddhist learned men to the administrative posts. Dahar had no control over the lower Sindh for 30 years from 670-700 AD. During that Brahman rule people were already divided into their loyalties towards Hinduism and Buddhism. Dahar also had no time to repair the loss of the irrigated areas due to change of course of the Indus. The Hinduism had threatened the very existence of the Buddhism and had ousted it out from most of the South Asia. Buddhists being farmers and pastorals were affected the most by change of river course. With divided loyalties of subjects Dahar seems to have given up Kutch to Kalyan Raja Chawra for good. The urban elite coexisting of Buddhist traders were interested in opening trade links with Iran and the Central Asia already occupied by the Arabs and welcomed the change to reopen these trade routes. Persian Jews settled at Debal had similar trade interests and helped in opening gates of Debal fort as they had done in Toledo (Spain) at exactly the same time.

The agriculture produce and exports were the same as during Rai dynasty era as discussed in previous chapter.

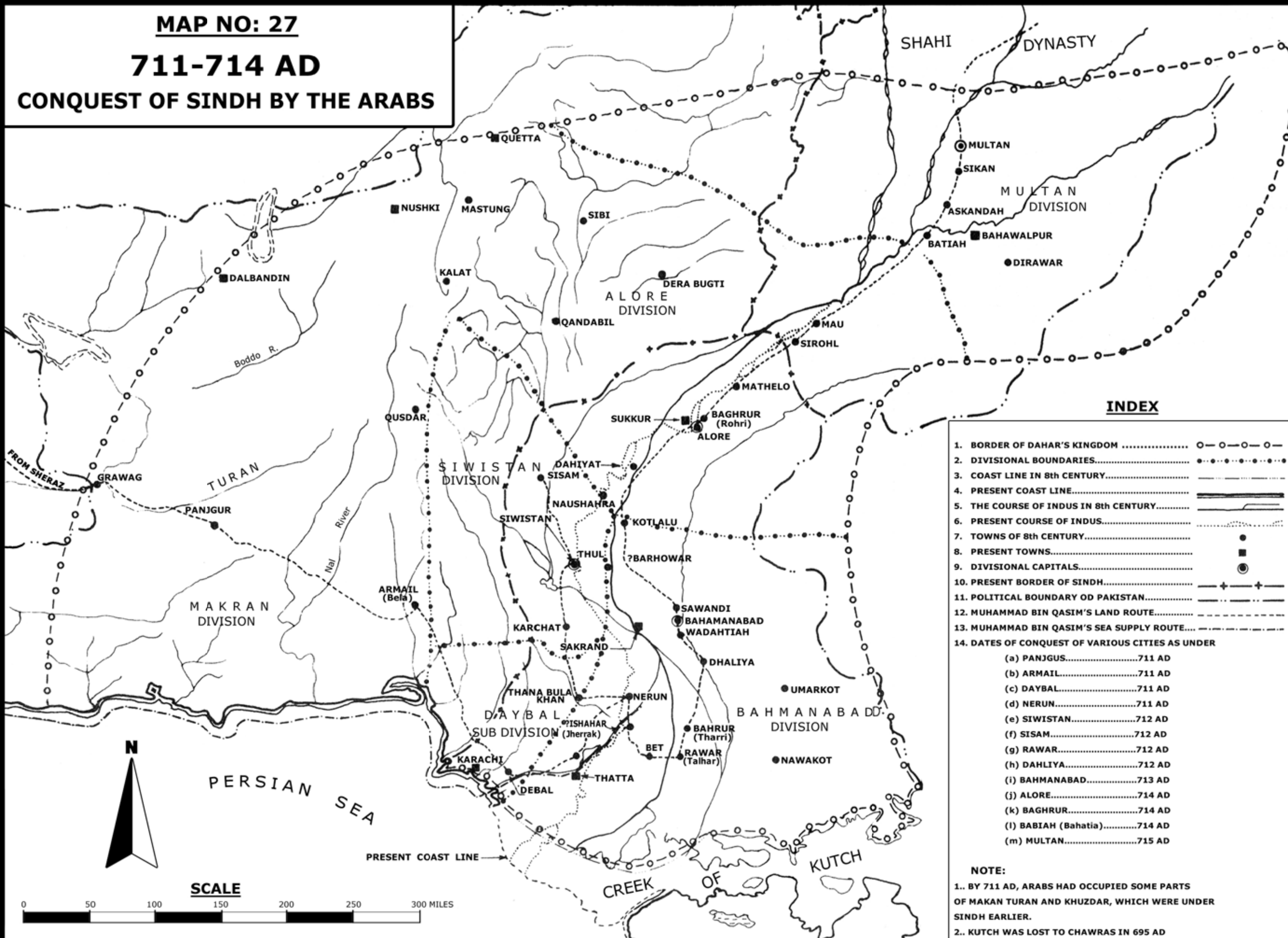
HSUAN-TSANG'S RETURN

765. Hsuan-tsang return in 645 to the Chinese (T'ang dynasty) capital at Ch'ang-an, with pack loads of Buddhist manuscripts gathered in 15 years scholarly travel.

MAP NO: 27

711-714 AD

CONQUEST OF SINDH BY THE ARABS



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12. MUHAMMAD BIN QASIM'S LAND ROUTE..................
13. MUHAMMAD BIN QASIM'S SEA SUPPLY ROUTE....
14. DATES OF CONQUEST OF VARIOUS CITIES AS UNDER
    - (a) PANJGUS..........................711 AD
    - (b) ARMAIL..........................711 AD
    - (c) DAYBAL..........................711 AD
    - (d) NERUN..........................711 AD
    - (e) SIWISTAN..........................712 AD
    - (f) SISAM..........................712 AD
    - (g) RAWAR..........................712 AD
    - (h) DAHLIYA..........................712 AD
    - (i) BAHMANABAD..........................713 AD
    - (j) ALORE..........................714 AD
    - (k) BAGHRUR..........................714 AD
    - (l) BABIAH (Bahatia)............714 AD
    - (m) MULTAN..........................715 AD

NOTE:

1.. BY 711 AD, ARABS HAD OCCUPIED SOME PARTS OF MAKAN TURAN AND KHUZDAR, WHICH WERE UNDER SINDH EARLIER.

2.. KUTCH WAS LOST TO CHAWRAS IN 695 AD

CHAPTER 22

IRRIGATION UNDER UMAYYAD AND ABBASID GOVERNORS OF SINDH; 711 - 746 AND 751 - 854 AD RESPECTIVELY

Sindh was conquered by Muhammad bin Qasim from 711 to 714 AD and soon after completion of conquests he was recalled as his father-in-law Hijaj bin Yousuf, governor of Basra, had died and new governor enemy of Hijaj had him arrested and killed. Two important factors were already at work against Dahar, the Brahman ruler of Sindh. The first was change of course of the River Indus, which destroyed the irrigation system in present Kotri Barrage ruining at least 25% of irrigated area in Sindh and the second was world over dry climatic period between 700 to 900 AD. The aridity had started in the southern Mediterranean countries from 630 AD. Due to these two factors people rebelled against Arab governors of both Umayyads and Abbasids during their rule from 714-854 AD. The table below gives list of the governors and their ultimate fate in local civil wars caused by shortage of water in the River Indus due to aridity and ruination of canals and irrigation due to neglect by governors who were unfamiliar with peculiar behaviours of the Indus and therefore the requirements of canals to flow and annual silt clearance.

Sr. No.	Name of governor	Period of rule in AD	Remarks
UMAYYAD GOVERNORS			
1.	Muhammad bin Qasim	711 – 715	Recalled after his father-in-law Hijaj's death, imprisoned and killed by new governor, an enemy of Hijaj.
2.	Yazid bin Kabashah	715 / 716	Died on 18th day of his arrival in Sindh.
3.	Amir bin Abdullah	715 / 716	Died within a few months of arrival.
4.	Habib bin Muhlab	716 – 717	Dismissed as Dahar's son Jasina recovered areas of Sindh east of the Indus and this governor failed to interfere in his authority.
5.	Amru bin Muslim	717 – 719	Dismissed by new Khalif.
6.	Hilal-Al-Tamimi	719/20 – 724	Removed by new Khalif Hisan bin Abdul Malik..
7.	Junaid bin Abdul Rahman	724 – 729	Reconquered whole Sindh, took expeditions against Gujarat, Ujjain, Chitor, Kutch and Broach, but was dismissed due to joining anti-Umayyad movement.
8.	Tamimal Utbi	729/30–730/31	Due to uprising against Arab rule and Arabs he abandoned Sindh and therefore was dismissed.
9.	Hakam-Al-Kalbi	730/31 – 738	He reconquered Sindh for Arabs and named Brahmanabad as Mansura where he settled Arabs from whole Sindh. He was killed in local uprising.
10.	Amar bin Muhammad bin Qasim	739 – 743	Dismissed by new Khalif Walid bin Yazid.
11.	Yazid-Al-Kalbi	743/44 – 746	Mansur bin Jamhur Al-Kalbi an Arab rebel defeated Yazid Al-Kalbi and killed him by burning him alive.
12.	Mansur bin Jamhur (independent ruler)	746 – 751/52	Defeated by Abu Muslim governor of eastern Abbasid empire, left for Thar desert where he died due to thirst.

CLAY JARS MOSTLY FOR STORAGE OF LIQUIDS


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766. Painted pot with narrowed bottom. Such pots were found from Mohenjo Daro. This type of vase with tapering sides, narrow base was common in the Indus culture and having wide shoulders (Marshall 1931, P1. LXXXI, 26 and Mackay 1943, 78). Spout is peculiar to 8th-14th centuries. (NM).
767. Wide mouth pot with spherical bottom and nozzle type spout. Decorative sun motif stamps used for decoration in 3 sizes, circular in shape, but spacing variable. The broad mouth and shouldered pot is similar to Mohenjo Daro pot (Marshall 1931, P1. LXXVI, I). It is stamped with a circular design similar to one on ear ornament of neighbouring countries.(NM).
768. Sindhi Kaunro, a globular vase with long neck, narrow mouth, handle and nozzle spout from Brahmanabad-Mansura. It can be difficult to handle compared to similar small Kaunro of twentieth century.(DGA).
769. Pot with fine design stamped on it. It is upright, flat bottom, narrow mouth storage jar. Nearest parallel is Mohenjo Daro pot (Marshall 1931, P1. LXXX), though having comparatively large mouth as shown in fig: no. 13. The vessel has very attractive shape. (NM).
770. Pot from Brahmanabad-Manusra similar to Mohenjo Daro as fig: no. 13. (NM).
771. Pot with flat bottom and spout. This vase is combination of wide rounded shouldered jar with flat base and similar vase was found from Mohenjo Daro, fig: no. 10. (Mackay 1938 P1. LXV, 21 and Mackay 1938, P1. LX, 31). (NM).
772. Pot with fine knurled design along belly or shoulders. It has narrow mouth, large shoulders and hemispherical shape below the shoulders, giving it beauty. There is no parallel in the Indus or pre-Indus culture of South Asia. (BM).
773. Heavy-duty storage jar with thick walls found intact from Soomra site Shah Kapoor. D 33 cms, H 38 cms. Probably for fermentation. (US).
774. Child bath, also considered as fruit basket, but is too heavy as fruit dish.(BM).
775. Decorative jar probably for liquors. (NM).
776. Highly decorative and stand jar probably for liquors from Brahmanabad-Manusra. (NM).

ABBASID GOVERNORS			
1.	Musa bin Kalbi Al-Tamimi	751/52-757/58	Ruled for five years and handed over to his son due to ill health.
2.	Ainia Al-Tamimi	757/58-759/60	A weak governor – rebelled – was defeated and killed by new governor.
3.	Amar bin Hafs Ataki	759/60-767	Pro-Shiite – was transferred to Africa.
4.	Hisam bin Amro	767-773	Reconquered Multan, which had become independent after Muhammad bin Qasim's recall. He returned to Baghdad honourably.
5.	Maabid Tamimi (brother of No.4)	773-775/76	Died in Sindh.
6. to 10.	Rub bin Hatim, Nasar Al-Shaith, A. Malik Mashai, Nasar Al-Shiath and Zubair bin Abbas		Transferred due to Jat uprisings. All his four successors could not control Jat uprisings and were replaced one after other.
11.	Masahid Taghurbi	775-778	There were serious fights between Hijazi and Yemanite Arabs and as governor could not control them he was dismissed.
12.	Laith bin Tarif	781/82-786/87	He could not control Jat rebels of Sindh and was dismissed.
13.	Salim Younisi	786/87-790/91	Transferred as he could not control uprisings in Sindh.
14.	Ishaque Hashimi and Yousif Hashimi	790/91-792	He died in Sindh, was replaced by his son Yousif for short time and later he too was replaced.
15.	Tayfur Al-Hamri	790/91-792	He being Yemenite supported Yemenites against Mudarites and was dismissed.
16.	Jabir Tai	792-793	Not being able to control uprisings was dismissed.
17.	Kathir Kalbi	793-794/95	Failed to control uprisings and was dismissed.
18.	Muhammad Saalabi	794/95-798	Dismissed as he could control Sindh or Multan.
19.	Abdul Rahman	798-798/99	Could not maintain order in Sindh and was dismissed.
20.	Ayoob bin Jafar	798/99-800	Removed as he could not maintain order.
21.	Mughira bin Yazid Muhlabi	800-801	Could not bring peace between Arab tribes and was removed and replaced by his brother Daud.
22.	Daud Muhlabi	801-820/21	To control Arab warring factions he destroyed settlements, massacred population of Mansura for 20 days. He died in Sindh.
23.	Bashar bin Daud Muhlabi (independent ruler)	820/21-828	Rebelled and did not pay tribute, therefore defeated and killed.
24.	Ghusan Muhlabi	828/29-831	Took three years to improve situation and was honourably transferred to Baghdad.
25.	Musa bin Yahya Barmaki	831-838	Died in Sindh, but had maintained order.
26.	Imran Barmaki	838-840/41	Jats and Meds rebelled and were crushed. In fight between Hijazis and Yemenites he helped the latter and was killed by Umar bin Abdul Aziz Habari head of Hijazi Sindhi Arab tribe.
27.	Ambasah bin Ishaque	840/41-849/50	Dismissed
28.	Haroon bin Ali Khalid	849/50-854/55	Governor in name only as Abbasids had no control over Sindh. Umar bin Abdul Aziz Habari had him assassinated and became ruler himself.

People were not in a position to pay the taxes and when forced by the Arab governors they resorted to fighting back and so boldly that 21 of the governors were dismissed by Damascus and Baghdad for their inefficiency to control rebellions, 13 were killed in action in local wars and only 5 returned back honourably in addition to Muhammad Bin Qasim.

TUMBLERS, CUPS, STANDS AND GLAZED AND PAINTED VASES


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777. Pitcher with strong and stout handle and large belly. Mohenjo Daro had cups with handles but no handles on large jars and pitchers. (NM).
778. Pitcher with large belly. H. 13 cms. External dia at mouth 7.75 cms. Internal dia at breast 10.1 cms. Internal dia at neck 5.9 cms. Bottom disc dia 6.6 cms. H. up to top of handle 14.35 cms. H. up to mouth 13.2 cms. (SN).
779. Pitcher with delicate handle from Brahmanabad-Mansura. (NM).
780. Tall pitcher but slim. (NM).
781. Pitcher similar to (90) from Brahmanabad-Mansura. (NM).
782. Pitcher with very wide mouth from Brahmanabad-Mansura. (NM).
783. Stone pitcher with handle broken and design of leaves cut on surface. (NM).
784. Tumbler with flared mouth. Similar tumblers are found at Mohenjo Daro (Mackay 1938, 201, Mackay Chanhu Daro 1943, 79 and Mackay 1938, P1. LXI, 21) as shown in figure (8 & 9). External dia at top 7.95 cms. Neck dia 5.7 cms. Breast dia 7.1cms. H 128.cms. Max. internal dia at neck 6.7 cms. (SN).
785. Painted pottery pieces with geometrical designs, fishes, etc, from Banbhore. (BM).
786. Painted pottery pieces with animal designs from Brahmanabad-Mansura. (NM).
787. 9th-11th century glazed jar in deep blue green colour, raised grape bunch design and 3 delicate loop handles probably for wine. Similar handles on pots repeat in Soomra pottery. (NM).
788. A delicate cup probably for wine, from Shah Kapoor.(US).
789. Stand for cups, lamps etc. Max. H. 14.3 cms, Bottom outside dia 19.55 cms. Internal dia bottom 8.9 cms. and top 11.55 cms. Venturi dia 5.9 cms. (SN).

The only cause could be ruination of irrigation system by either change of course of River Indus or its deterioration by neglect as the new officials would hardly be familiar with complex factors involved in maintenance of canals due to the peculiar behaviour of the river. These officials following the Persian practice became the Jagirdars themselves. Not being familiar with clearance of canals once these were neglected the area under cultivation was reduced, revenue went down and all capacity for building new canals or repairing the existing ones was lost. The vicious cycle once started could only be overcome by funds from the central treasury. We know that funds were available at the centre, but such finances did not flow back either from Damascus or Baghdad. This must have reduced cultivated area and consequently the population of the province. Irrigation system had to wait for more than a century-and-quarter to be restored by Habaris after 854 AD.

The neglect of maintenance of canals led to reduction in area under cultivation. This in turn created unemployment and rebellion against the governors. The deterioration of law and order led to further neglect of maintenance of canals and the vicious circle started.

DRY CLIMATE, FALL OF SINDH TO ARABS AND 140 YEARS OF CIVIL WAR AGAINST ARABS

From 700-900 AD was dry period throughout the world. Expansion of Islam and weakening of Byzantine Roman Empire is considered due to aridity around the southern Mediterranean countries from 630 AD onwards. Around 700 AD the River Indus changed its course deserting the canal system in the whole southern Sindh, which was vacated by the populace and the Arab armies marched under Muhammad bin Qasim through this deserted area unhindered. A few years' aridity had weakened Sindh so much that Sindh fell an easy prey to the Arab armies.

During the Arab governors' rule there was continuous chaos, turmoil, local uprisings, wars, frequent replacements, transfers and dismissals of the governors. There were a few occasions when most of the Arabs were thrown out of Sindh and reconquest by them became necessary. Between 714 and 749 AD eleven Umayyad governors had succeeded Muhammad bin Qasim. In one-hundred-and-four years of Abbasid rule twenty-eight governors changed hands; majority of whom were dismissed, and surprisingly this happened when Arab empire was at the zenith of its glory.

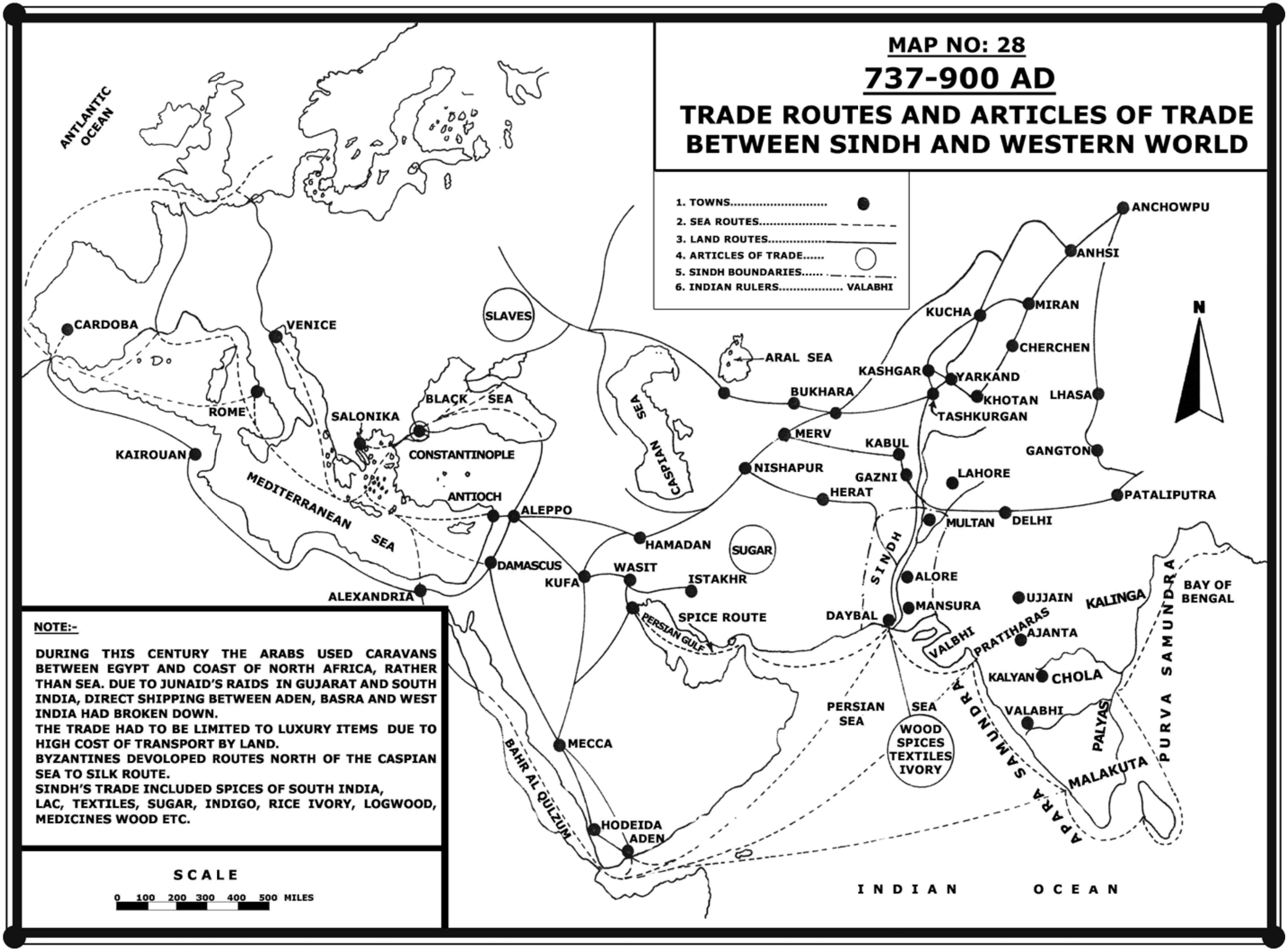
Tabri reports that Jagirdari system (land tenure) was developed by Sassanids, copied by Arabs and inducted in Sindh by them. It was brought to the rest of South Asia by the Delhi Sultans and reached its full development under Mansabdari system of Akbar. It attained its full stage of exploitation under Shah Jehan when farmers deserted the lands rather than cultivating them as is detailed by Mirak in Mazhar Shah Jehani.

790. **Picture from Jami-ut-Tawarikh of Rashiduddin, a mongol employee. He has shown Mahmud's army dressed like Mongols and his fort wall scaling machines. (ELA).**

MAP NO: 28

737-900 AD

TRADE ROUTES AND ARTICLES OF TRADE BETWEEN SINDH AND WESTERN WORLD



NOTE:-

DURING THIS CENTURY THE ARABS USED CARAVANS BETWEEN EGYPT AND COAST OF NORTH AFRICA, RATHER THAN SEA. DUE TO JUNAID'S RAIDS IN GUJARAT AND SOUTH INDIA, DIRECT SHIPPING BETWEEN ADEN, BASRA AND WEST INDIA HAD BROKEN DOWN.
THE TRADE HAD TO BE LIMITED TO LUXURY ITEMS DUE TO HIGH COST OF TRANSPORT BY LAND.
BYZANTINES DEVOLOPED ROUTES NORTH OF THE CASPIAN SEA TO SILK ROUTE.
SINDH'S TRADE INCLUDED SPICES OF SOUTH INDIA, LAC, TEXTILES, SUGAR, INDIGO, RICE IVORY, LOGWOOD, MEDICINES WOOD ETC.

SCALE

0 100 200 300 400 500 MILES

CHAPTER 23

IRRIGATION UNDER HABARIS' RULE OF SINDH; 854 - 1011 AD

CLIMATIC OPTIMUM

The period 900-1250 AD is considered as a very warm and moist period throughout the world with more rain fall and higher level of water in River Indus. It is called "Climatic Optimum" world over.

Habaris of Sindh were descendants of Habar bin al-Asad a member of Banu Asad Qureshi. Ibn Zubayr a descendent of Habar came to Sindh with Hakam al-Kalbi the governor of Sindh around 730 AD. These immigrants brought only a few women. During the next century and quarter they intermarried among the Sindhis, learnt local language, wore local dress, adopted local customs, became landowners, developed influence among local Sindhi tribes and finally overthrew the Abbasid governor in 854 AD establishing their own independent dynasty which ruled for 157 years.

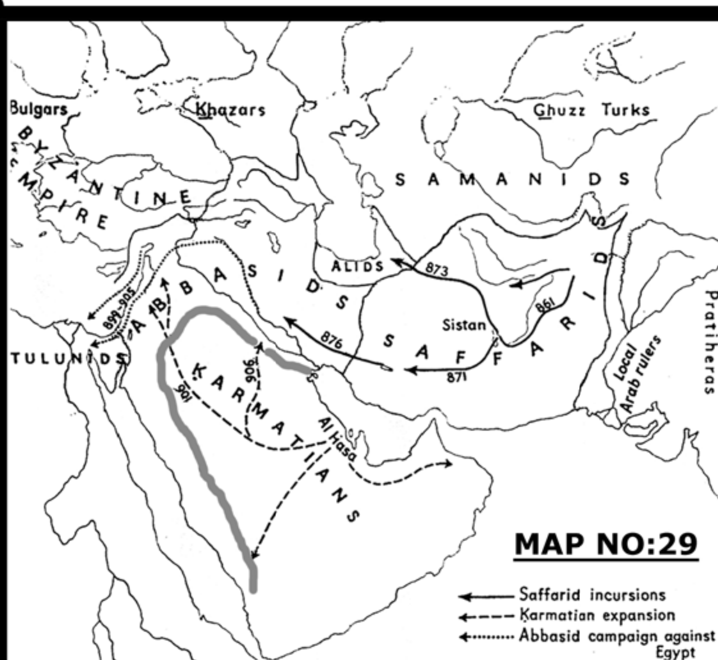
The rulers were:

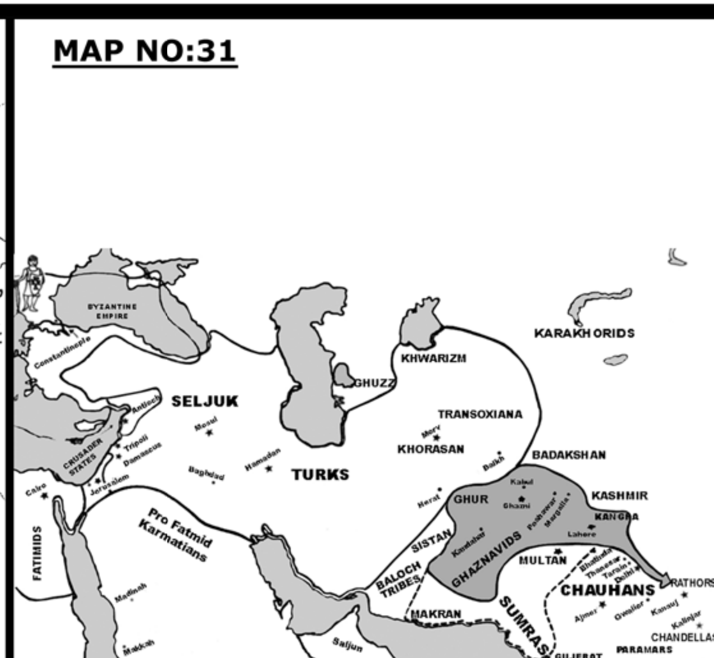
1.	Umar bin Abdul Aziz	854/55 – 883/84
2.	Abdullah bin Umar	883/4 – 903
3.	Musa bin Umar	903 – 912/3
4.	Umar bin Abdullah	912/3 – 941/42
5.	Muhammad bin Abdullah	941/42 – 970/71
6.	Ali bin Umar	970/71 – 985/86
7.	? bin Ali bin Umar	985/86 – 1010/11

During their rule the number of Arab travellers, traders and geographers visited Sindh and wrote their accounts, which show:

a) Sindh was peaceful and prosperous country.
b) Agriculture flourished and a number of crops, vegetables and fruits were grown in Sindh and were exported. Arab travellers, geographers and historians namely; Ibn Khurdadba, Abu Zaid, Yaqoobi, Hamadani, Buzrig bin Shahryar, Masaudi, Yanubi, Ibn Haukal, Istakhri and Muqadisi who had visited Sindh or collected information.
c) They were tolerant to other faiths - Hinduism and Buddhism and had developed cordial relations with the Hindu rulers of the neighbouring countries. Their relations with local population and tribes also appeared to be good. During their rule Buddhist stupas were repaired and renovated as per archaeological evidence.
d) There was no law and order problem.
e) Instead of depending on local chiefs for supply of soldiers they maintained 80 elephants and 40,000 foot-soldiers from the central exchequer.
f) Trade relations between the South Asia and Muslim world reached the climax.

Such peaceful atmosphere, security and freedom to trade shows that during this period irrigation system, which was ruined under rule of Umayyad and Abbasid governors, was restored and gradually extended as population grew. There were enough agricultural surpluses to support the government soldiery and urban population, besides the foreign trade. Under Umayyad and Abbasid rule population must have gone down and with improvement of irrigation under the Habaris population again rose, more area was canalised and more land brought under plough. Under the pre-British irrigation system in the days of the Kalhoras period the area under irrigation in Sindh could have reached up to 2.1 million acres, which supported population of three millions. It is possible that under any peaceful regime lasting about a century similar cultivation figures and similar extent of population could be achieved. But Kalhoras had reached this figure just in first fifty-seven years of their rule. The map shows the Habari kingdom, the course of River Indus in the ninth and tenth centuries and important urban centres. The Habaris had unique luck in having an even distribution of the natural branches of the River Indus all over the plains. For





MAP NO:29

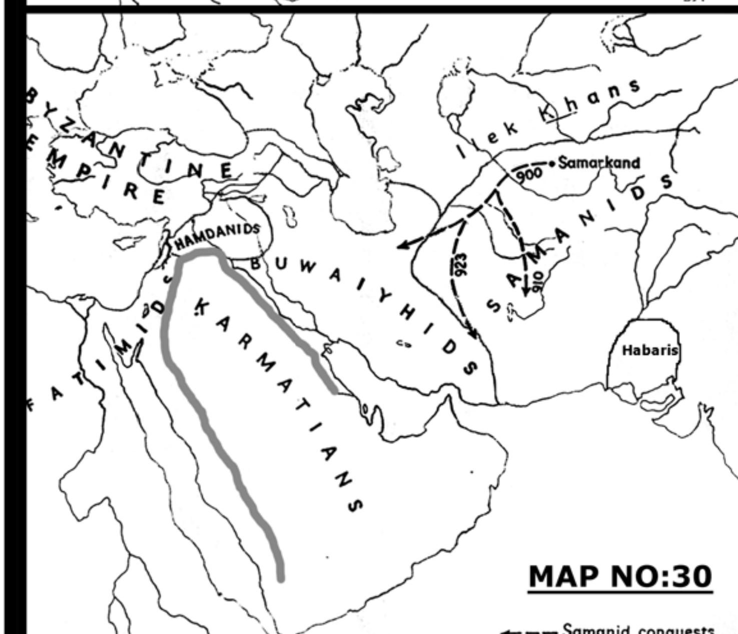
9TH CENTURY

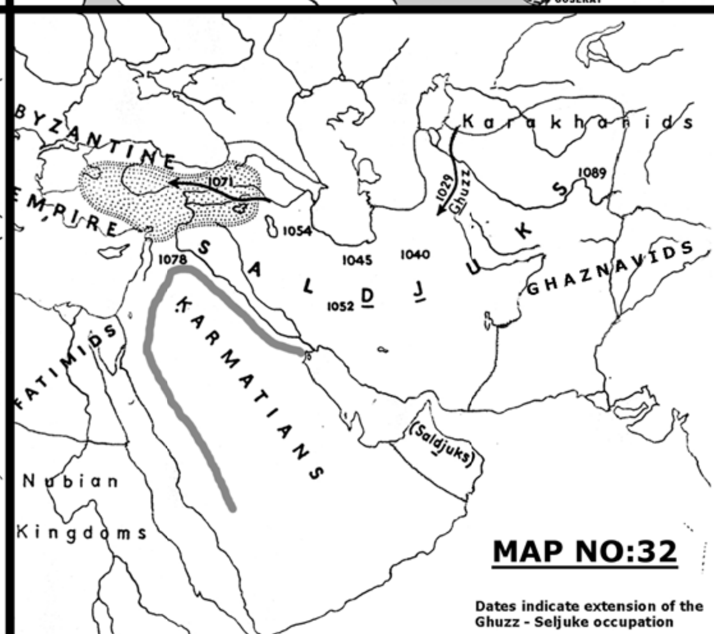
BEGINNING OF THE BREAK-UP OF ABBASID EMPIRE AND DATES

MAP NO:30

10TH CENTRY

CARMIDS, KARMATIANS, BUWAHIDS AND SAMANIDS AND DATES





MAP NO:31

11TH CENTURY

GHAZNAVID EMPIRE

MAP NO:32

12TH CENTURY

SELJUK'S INVASIONS AND GHAZNAVIDS AND DATES

example:-

a) The western branch of the Indus taking off from the main river between Kandhkot and Kashmore cut through the Kandhkot and Thul talukas to Shahdadkot taluka where it turned southwards to the Manchar Lake.

b) A branch from the above starting north-east of Shikarpur ended into present alignment of Warah branch. From there it moved south to meet the western branch again near Kakar in Khairpur Nathan Shah taluka.

c) The main river had its bed along Sindh Dhoro in Kandhkot and Sukkur talukas. At Ruk it made south-eastern turn to pass through Lohano Dhoro.

d) At Naushehro it shot a western branch, which met Aral canal (filling and discharging Manchar Lake) near Qazi Ahmed.

e) Another eastern branch from the main course of the river starting some twenty-five miles north of Nawabshah joined Eastern Nara in Samaro taluka.

f) In the lower Sindh its branches were along the alignment of the Dhoro Puran, the western Puran, the Ahmed Rajo and finally from Talhar to Banbhore.

g) The main river confined its flow along Golarchi branch.

h) Sarsuiti-Hakra system was still active in the inundation season from the spill waters of the Indus and the Sutlej though with much reduced supplies. Yet it contributed towards irrigation of Kharif crops especially below the present Jamrao Head as the Eastern Nara acted regulatory reservoir.

The above courses are based on the study of aerial photographs by Holmes and corrected by the present writer. The important towns of the period were: Mansura (Brahmanabad), Jhim, (Jhimpir) Debal, Kalari, Bolari, Anari, Alore, Baghrur, Sadusan (Sehwan), Manjabari (Mangho Pir), Nerun, Baniya, Maniya, Vinjrot, Mathelo, Thul Mir Rukan, Dhaliya (Mirpurkhas), Naukot, Talti, Budhjo Takar and Gujo.

Irrigation in Sindh never reached the same status until under Kalhoras eight hundred years later and the British around 1900 AD. The cultivation figure may have reached two million acres and the population about three millions. During such prosperity Hinduism, Buddhism and Islam flourished side-by-side and Buddhist stupas were being renovated.

The agricultural products of Sindh as described by Arab travellers visiting during this period were:

- Sugar cane as most important crop,
- Limo (Lemon),
- Adrak (asafoetida),
- Mango,
- Orange,
- Cotton,
- Rice,
- Wheat,
- Sorghum and millets,
- Camphor,
- Saffron,
- Jera,
- Garden products,
- Medical plants,
- Aloe Vera and
- Honey (forest, garden and vegetable product).

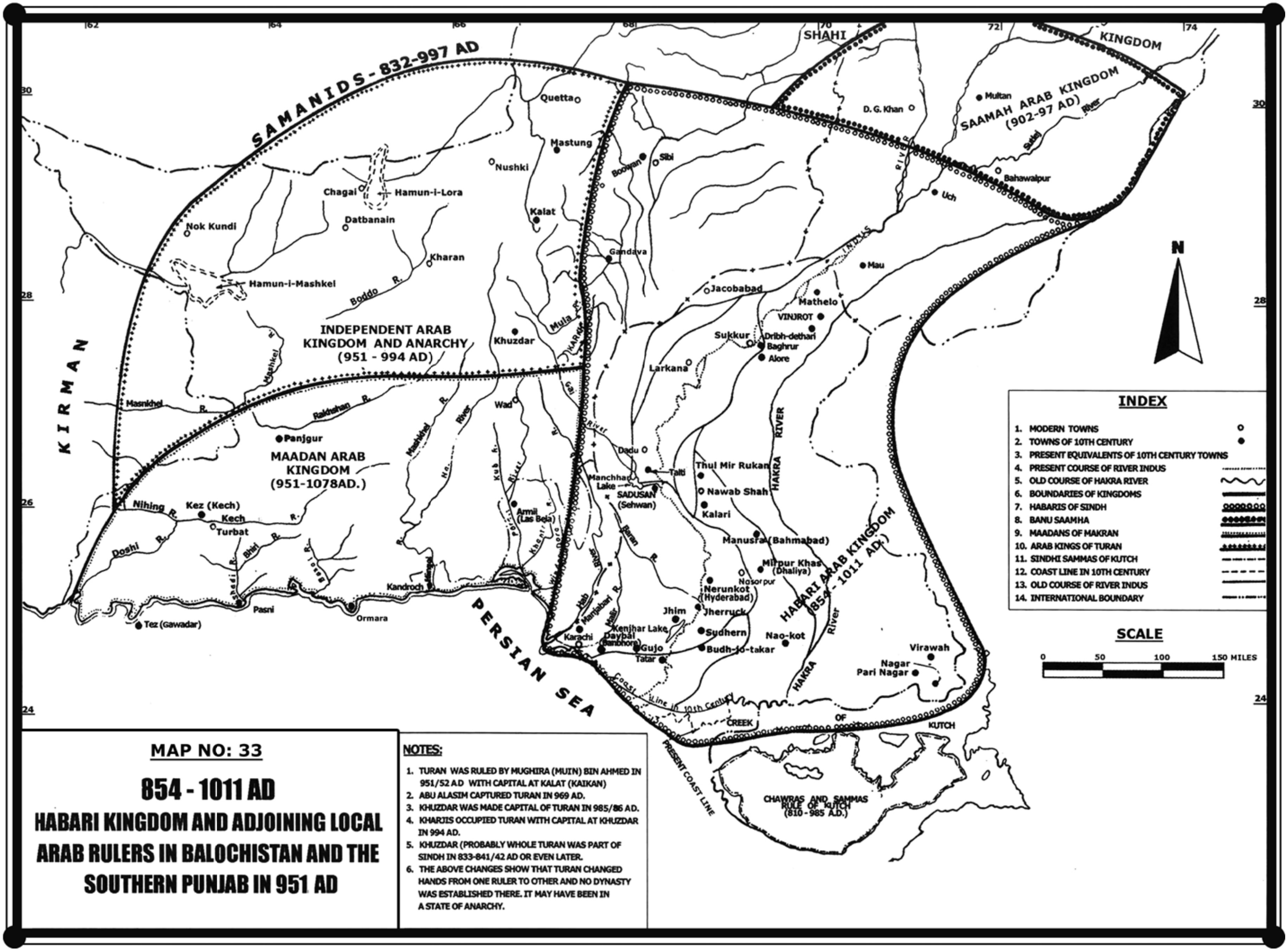
Industrial crops like indigo and madder were in addition to food grains (rice, wheat and barley), oil seeds, pulses and vegetables. Main industrial crop was cotton. Grains, butter, oils, hides and textiles were major items of export

Sugar cane is a perennial crop, which shows that a substantial area had perennial canals from which water was lifted by Persian wheels in winter. (Istakhri states that whole country was covered with fields, gardens and trees). Acidic citrus originated in India and sweet citrus in China. In the tenth century AD sweet citrus was already known and grown in India. Hot climate of Sindh allows citrus to grow in Sindh, but high respiration demand causes high consumption of carbohydrates (sugars) and therefore citrus in Sindh passes quickly from acidic state to sweet state and if not harvested quickly deteriorates to sub-standard grades. Therefore citrus is harvested when still slightly acidic. That's why Arab travellers called all citrus varieties in Sindh as Limo (Lemon) – an acidic sub-species of citrus.

During this period Thar and Kohistan could also support twice much animals as now and so the human population. Animal husbandry and its byproducts must have been important items for local consumption and export.

Baghdad, which had developed into important trading centre under Abbasids after 751 AD replacing Damascus, was over shadowed by Cairo under Fatimids in the tenth century. In Europe Venice had overshadowed Constantinople. In Debal Persian Jews who settled since third century AD were still actively trading with the help of other Jews settled in big towns in the whole Asia.

Dinar had become an important and common coin in countries bordering the Indian Ocean. Habaris minted their own coins.



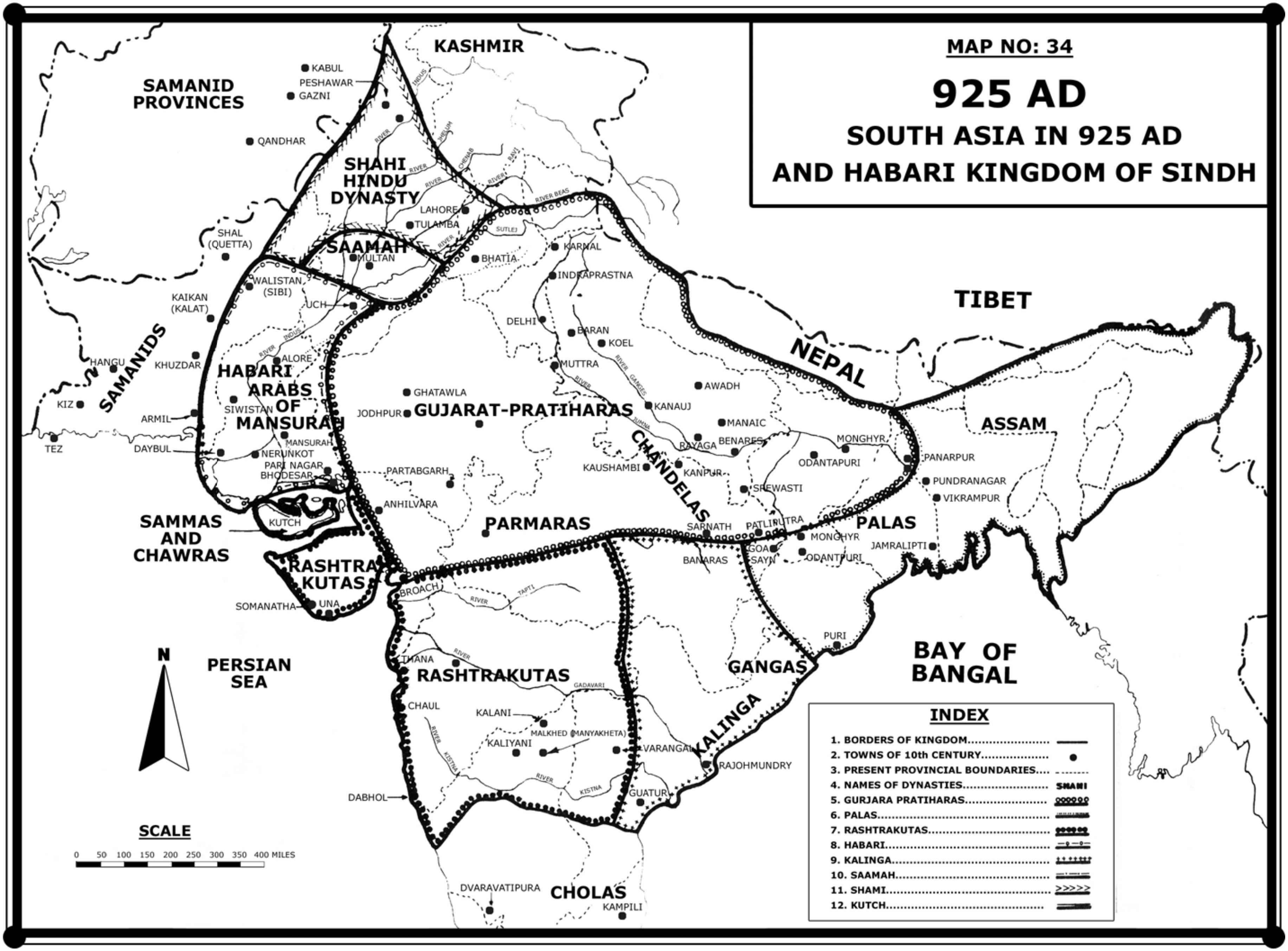
MAP NO: 33

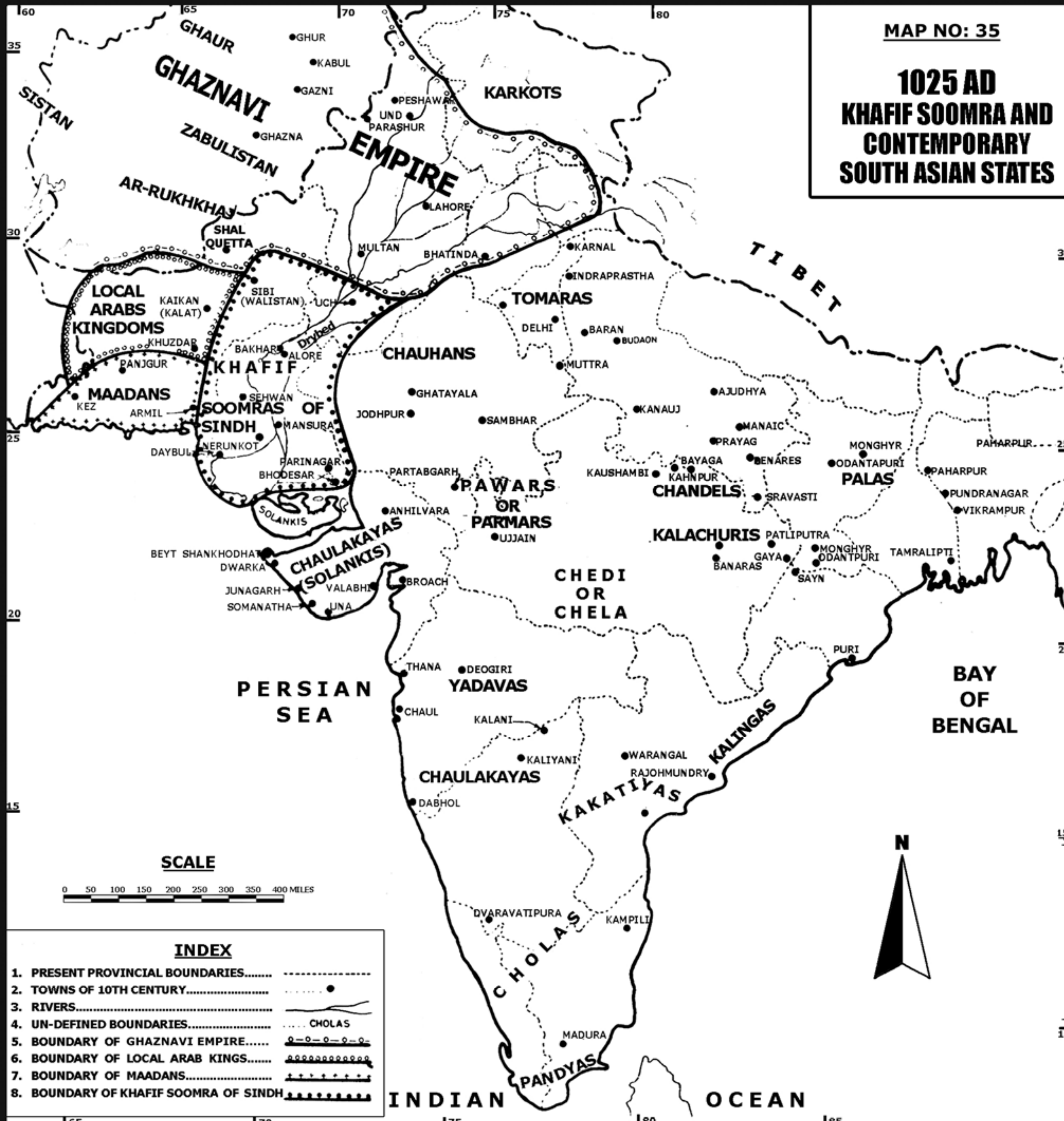
854 - 1011 AD

HABARI KINGDOM AND ADJOINING LOCAL ARAB RULERS IN BALOCHISTAN AND THE SOUTHERN PUNJAB IN 951 AD

NOTES:

1. TURAN WAS RULED BY MUGHIRA (MUIN) BIN AHMED IN 951/52 AD WITH CAPITAL AT KALAT (KAIKAN)
2. ABU ALASIM CAPTURED TURAN IN 969 AD.
3. KHUZDAR WAS MADE CAPITAL OF TURAN IN 985/86 AD.
4. KHARJIS OCCUPIED TURAN WITH CAPITAL AT KHUZDAR IN 994 AD.
5. KHUZDAR (PROBABLY WHOLE TURAN WAS PART OF SINDH IN 833-841/42 AD OR EVEN LATER.
6. THE ABOVE CHANGES SHOW THAT TURAN CHANGED HANDS FROM ONE RULER TO OTHER AND NO DYNASTY WAS ESTABLISHED THERE. IT MAY HAVE BEEN IN A STATE OF ANARCHY.


MAP NO: 34
925 AD
SOUTH ASIA IN 925 AD
AND HABARI KINGDOM OF SINDH
KASHMIR
SAMANID PROVINCES
KABUL
PESHAWAR
GAZNI
QANDHAR
SHAHI HINDU DYNASTY
LAHORE
TULAMBA
SAAMAH
MULTAN
BHATIA
SUTLEJ
RIVER BEAS
SHAL (QUETTA)
WALISTAN (SIBI)
UCH
KAIKAN (KALAT)
SAMANIDS
HANGU
KHUZDAR
KIZ
TEZ
ARMIL
DAYBUL
ALORE
HABARI ARABS OF MANSURAH
SIWISTAN
MANSURAH
NERUNKOT
PARI NAGAR
BHODESAR
KUTCH
SAMMAS AND CHAWRAS
RASHTRA KUTAS
SOMANATHA
UNA
KARNAL
INDRAPRASTNA
DELHI
BARAN
KOEL
MUTTRA
GHATAWLA
JODHPUR
GUJARAT-PRATIHARAS
PARTABGARH
ANHILVARA
PARMARAS
AWADH
KANAUJ
MANAIC
CHANDELAS
KAUSHAMBI
RAYAGA
BENARES
KANPUR
SREWASTI
SARNATH
PATLIPUTRA
BANARAS
GOA
SAYN
MONGHYR
ODANTAPURI
ODANTPURI
PALAS
JAMRALIPTI
PANARPUR
PUNDRANAGAR
VIKRAMPUR
NEPAL
TIBET
ASSAM
PURI
BAY OF BANGAL
GANGAS
KALINGA
RAJOHMUNDRY
VARANGAL
GUATUR
BROACH
TAPTI
THANA
RASHTRAKUTAS
GADAVARI
CHAUL
KALANI
MALKHED (MANYAKHETA)
KALIYANI
KISTNA
DABHOL
DVARAVATIPURA
CHOLAS
KAMPILI
N
PERSIAN SEA
SCALE
0 50 100 150 200 250 300 350 400 MILES
INDEX
1. BORDERS OF KINGDOM
2. TOWNS OF 10th CENTURY
3. PRESENT PROVINCIAL BOUNDARIES
4. NAMES OF DYNASTIES
SHAMI
5. GURJARA PRATIHARAS
6. PALAS
7. RASHTRAKUTAS
8. HABARI
9. KALINGA
10. SAAMAH
11. SHAMI
12. KUTCH



791. A view of Bakhar Fort, Sukkur

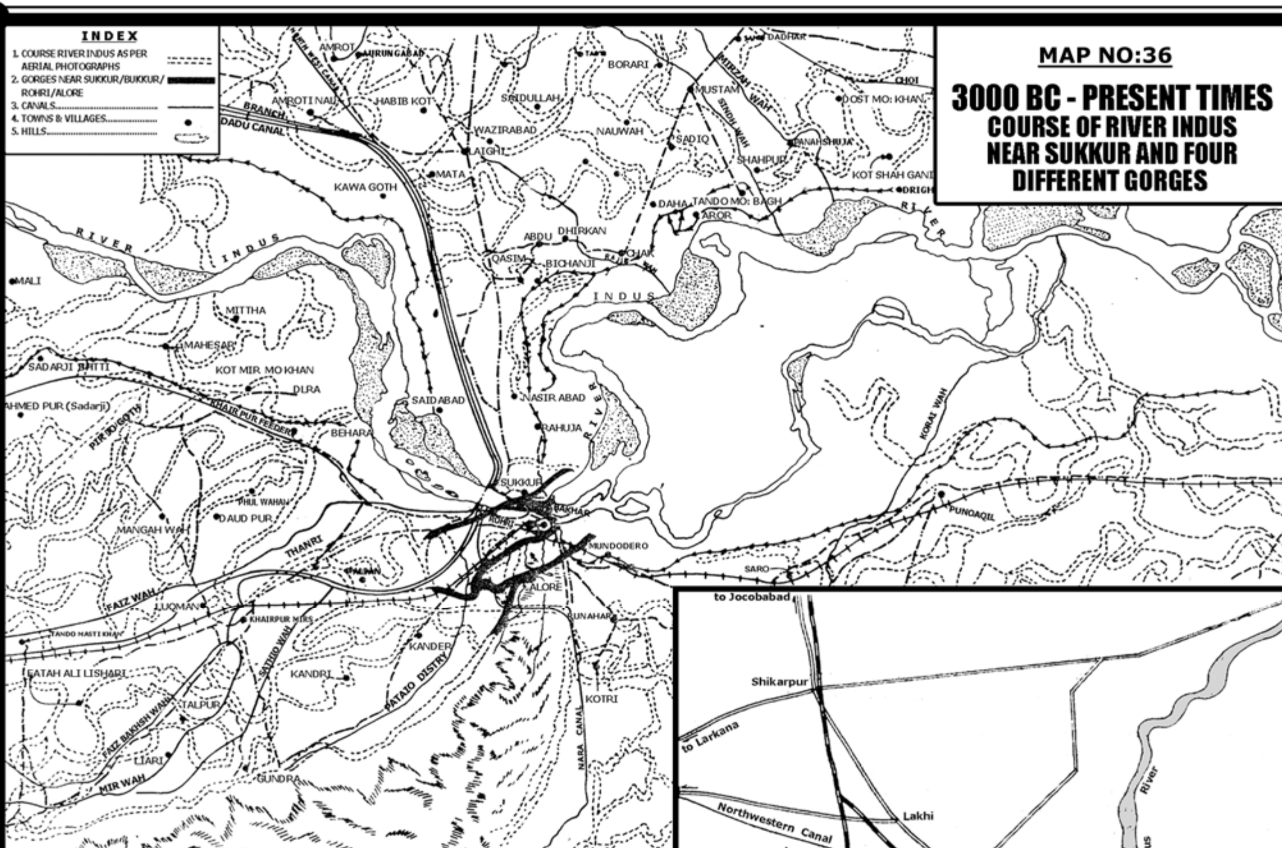
CHAPTER 24

IRRIGATION UNDER SOOMRAS; 1011 - 1351 AD

Soomras ruled Sindh for 340 years; the largest period of rule of any dynasty in Sindh or any part of South Asia.

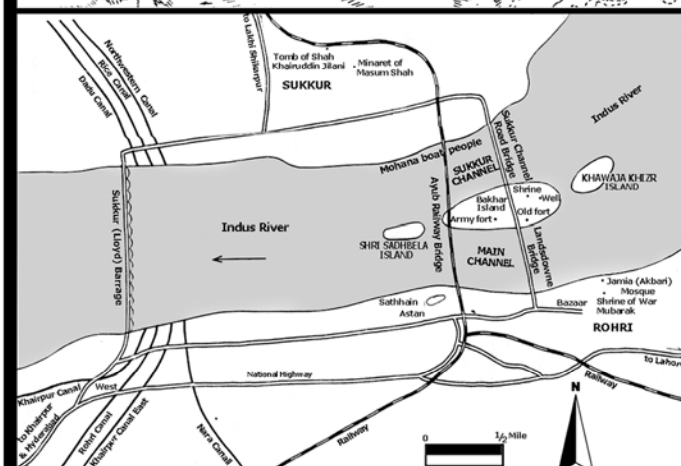
The rulers of this dynasty were as under:

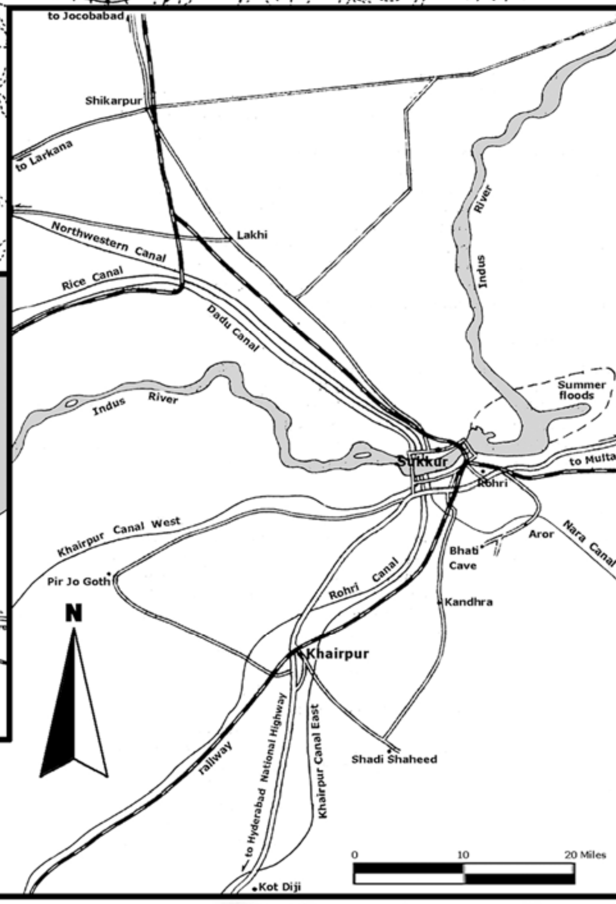
S. No.	Ruler	Years of rule AD		
1.	Khafif – I	1011	-	1026
2.	Soomar	1026/27	-	1054/55
3.	Bhoongar-I	1054/55	-	1068/69
4.	Dodo-I	1068/69	-	1092
5.	Zenab Tari (sister of Dodo ruled on behalf of her minor brother Sanghar)	1092	-	1098
6.	Sanghar (no child)	1098	-	1106/07
7.	Khafif-II (brother of wife of Sanghar)	1106/07	-	1141/42
8.	Umar-I (brother of Khafif-II)	1141/42	-	1180/81
9.	Dodo-II.	1180/81	-	1194/95
10.	Bhoongar-II (descendent of Dodo-I and not Dodo-II)	1194/95	-	1222
11.	Chanesar-I	1222	-	1228
12.	Gunero-I	1228	-	1236/37
13.	Chanesar – I (second time)	1236/37	-	?
14.	Gunero-I (second time)	?	-	1241/42
15.	Tur (Muhammad Tur son of Gunero-I)	1241/42	-	1256
16.	Gunero-II	1256	-	1259
17.	Dodo-III (son of Gunero-II)	1259	-	1273/74
18.	Tai (son of Dodo-III)	1273/74	-	1283/84
19.	Chanesar – II	1283/84	-	1300/01
20.	Bhoongar-III	1300/01	-	1315
21.	Khafif – III	1315	-	1332/33
22. 23. 24.	Dodo – IV Umar-II Bhoongar-IV	1332/33	-	1350
25.	Hamir (Dodo)	1350	-	1351/52



MAP NO:36

3000 BC - PRESENT TIMES COURSE OF RIVER INDUS NEAR SUKKUR AND FOUR DIFFERENT GORGES





MAP NO:37

ISLANDS NEAR SUKKUR-ROHRI

MAP NO:38

SUKKUR AND PRESENT ENVIRONMENTS

792. Khawaja Khizir, an island in Sukkur gorge.

793. Sadhbelo island in Sukkur gorge.

The secret lies in the climate considered to be optimum in the past ten thousand years. Many branches of the Indus and governments were in the hands of the people who knew speciality needs of irrigation in Sindh. Bhaiyat system introduced in Kutch in 1147 AD by immigrant Sammas of Sindh must have been copy of Sindh's Bhaiyat or brotherhood under which communities were assigned common lands to be cultivated as per needs of people, which were met.

The period from 900 to 1250 AD was warm and “Climatic Optimum”, discussed in previous chapter, continued. The population and irrigated area remained at three million people and two million acres respectively.

This period has remained a historical mystery due to absence of historical records. The ballads pertaining to this period were actually composed in the fifteenth century. From almost scanty information scattered over large number of sources the present writer has been able to build a chronology of events of this period and has also published “An Illustrated Historical Atlas of Soomra Kingdom of Sindh” having detailed chapter on agriculture and irrigation.

There is concentration of settlements in the lower Sindh. Comparing the Rriver Indus courses in Habari era with Soomra period it is clear that the river had abandoned its old course ruining the irrigational system. The upper Sindh changed hands frequently during this period. Sindh was made a tributary state by Sultan Mahmud Ghaznavi in 1026 AD, but soon after his death or the latest by 1040 AD it regained independence. In 1206 AD it was subdued by Qabacha a general of Qutub Din Aibak and the upper Sindh up to Sehwan was ceded to him. The lower Sindh accepted vassalage of Illtatmish in 1228 AD, but by about 1239 AD the whole of Sindh became independent under Soomras. It was subdued again in 1297 AD by Allauddin’s general to be ruled by Soomras as vassals. Soon after 1333 AD Sindh regained independence under Unar Jam the joint leader of Soomras and Sammas. The latter ousted Soomras around 1351/52 AD. It is difficult to ascertain if it was one or more dynasties of Soomras who ruled Sindh during these three-hundred-and-forty years.

They shifted their capital three times from the original capital at Mansura. The probable dates of change of capitals are:

- Between 1026 and 1040 AD; from Mansura to Tharri (eight miles east of Matli).
- Between 1241 and 1257 AD; from Tharri westward on new branch channel on which stood the town of Jun.
- From 1257 to 1300 AD; from Jun to Muhammad Tur (Mahatma Tur) on Gungro channel of the Indus River.
- Soon after 1300 AD; from Muhammad Tur to Thatta.

The first three shifts of capital were necessitated by change in the course of the River Indus on each occasion. The first change occurred soon after 1026 AD when the river deserted Mansura. The map (1000 -1525 AD) shows that the river most probably deserted the old course in present Nawabshah district and joined the western Puran some five to ten miles east of Tharri. The other major change took place during the rule of Muhammad Tur Soomra (1241/42-1256 AD) when the river established itself near Oderolal and Nasarpur and a branch of it separating from the main river at Kinkot north of the present Tando Muhammad Khan took to Lahri Bunder. The other branch cut Gungro on which was built the capital town Muhammad Tur. The Indus also had a western branch taking off from it north of Kashmore and a Soomra town Janani was built on it in Kamber taluka four kilometres west of Warah town where ruins of an old settlement exist. A deh and small inspection bungalow of the same name still exist at Janani. This city was visited by the Arab traveller Ibn Battutta in 1333 AD.

The fourth change in the course of the Indus occurred soon after 1300 AD when the river deserted Gungro and the major part of its waters started flowing through Baghar branch. It also reduced supplies to Kalri branch flowing into Gharo Creek. This separation took place near present town of Bulri. The western branch of the Indus also deserted its old course and formed another channel eastwards, but parallel to its old course down to Manchar Lake.

The first three changes must have affected the lower Sindh, but the third change affected not only the lower Sindh but also the north-western Sindh – Jacobabad, Shikarpur, Larkana and Dadu districts badly. Shifting of population on a large scale from the lower Sindh to the north-western Sindh took place. These mostly were the Samma clans who even to this day form majority population in this area. This helped Sammas to strive for power and shortly afterwards replace Soomras. It was around 1226 AD that Hakra finally dried up due to reduction in spill water of the Indus and the Sutlej and population settled on it had

1011-1351 AD COURSES OF THE RIVER INDUS AND ITS BRANCHES IN VARIOUS AREAS OF SINDH DURING SOOMRA RULE.

MAP NO: 39

JACOBABAD, SHAHDADKOT AND WARAH COURSES OF THE RIVER INDUS ON THE RIGHT BANK IN 8TH-14TH CENTURIES

MAP NO: 40

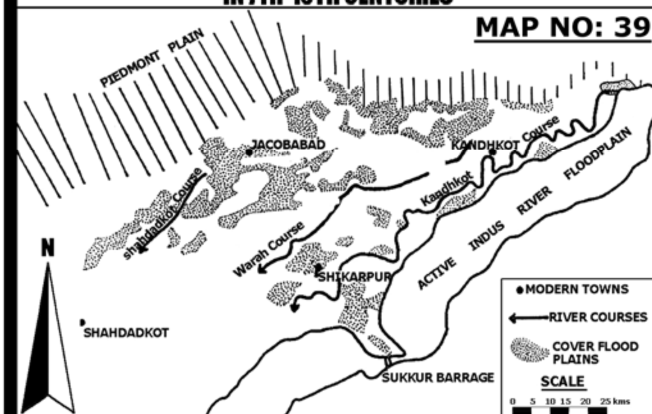
WARAH, WESTERN NARA AND DADU COURSES OF THE RIVER INDUS IN 8TH-14TH CENTURIES

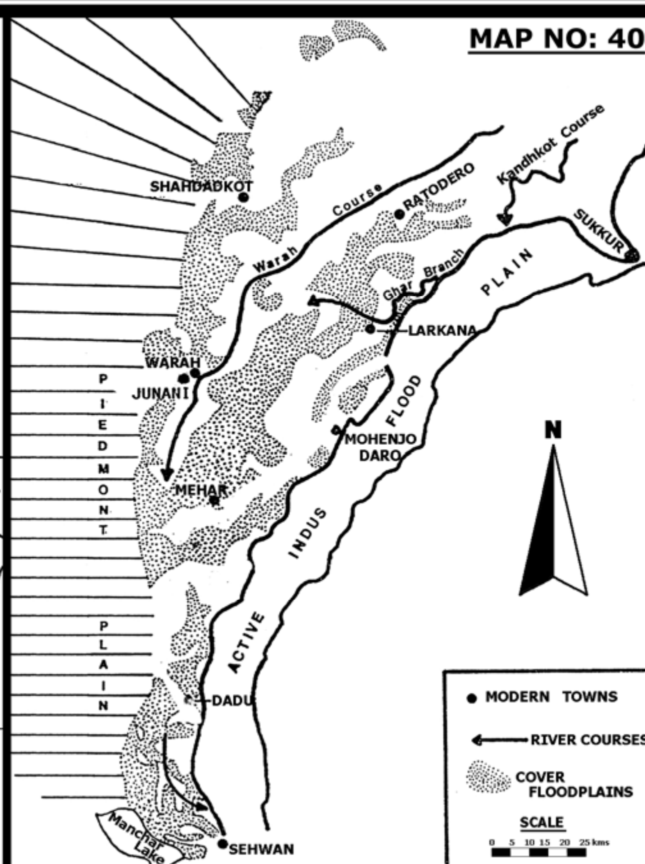
MAP NO: 41

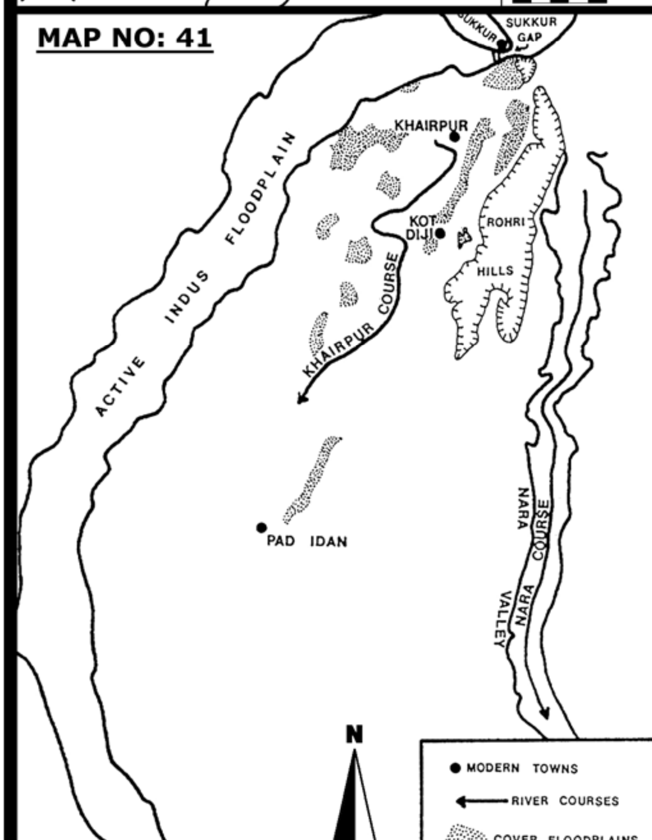
KHAIRPUR COURSE OF THE RIVER INDUS ON THE LEFT BANK DURING 7TH-14TH CENTURIES

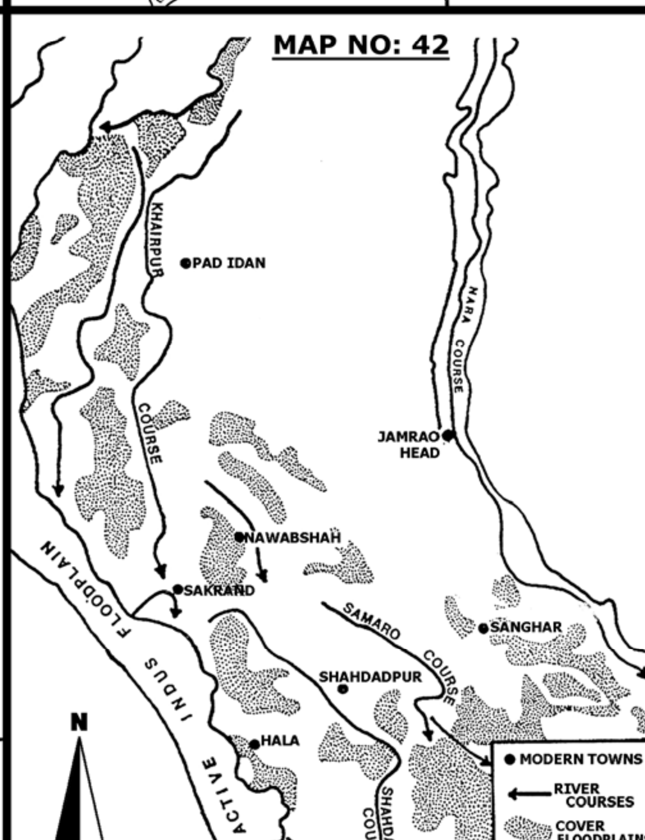
MAP NO: 42

KHAIRPUR, SANGHAR, SAMARO AND SHAHDADPUR COURSES OF THE RIVER INDUS ON THE LEFT BANK IN CENTRAL SINDH IN 7TH-13TH CENTURIES









to be shifted. Thus, in three-hundred-and-forty years Sindh witnessed ruination of irrigation canal system three times. Each change would bring famine conditions, migration of population, resorting to pastoral nomadism, disease, death, reduction in population and also possibly some changes in the government. Due to these changes in the lower Sindh below the line running west to east of Tando Muhammad Khan a large number of towns were deserted. There is no record of names of canals available. Attempts have been made to reconstruct historic, economic and social conditions from ballads pertaining to this period, but these documents are unreliable as they were composed in the fifteenth century and afterwards. At the best they are guess work based on local traditions. One important development of the period was burning of Debal the ancient Barbarican or Banbhore by Jalaluddin Khawarizm Shah in 1226 AD. It possibly was Alexander's Haven as his historians called it. For about 1600 years this settlement on Gharo Creek and Kalri branch of the River Indus served as Sindh's leading port. The Kalri branch of the river too changed its course soon afterwards. New port was established on Baghar branch of the River Indus and named as Lahri Bunder. Baghar branch was unstable and changed course and Lahri Bunder on it changed its sites many times. A number of sites claimed as those of this port are indeed all Lahri Bunders flourishing between thirteenth and seventeenth centuries. One such site occupying an extensive area had Portuguese fort and church built in sixteenth century – now in ruins.

Another important development was the final drying up of Hakra thereby affecting some irrigated area in Sanghar and Tharparkar districts where probably jawar and bajra were the crops raised on water available from spill waters from the Indus and the Sutlej for about one month – not regularly.

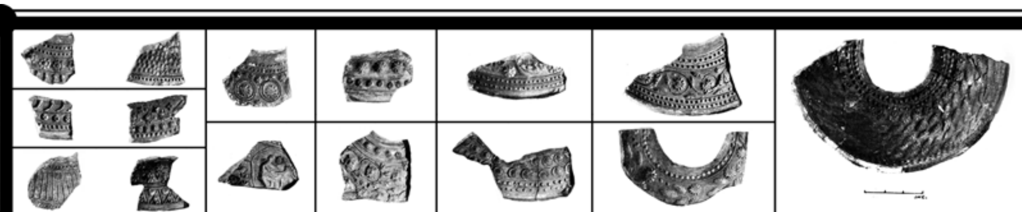
Presumably the agricultural exports from Sindh during the period were: cotton, textiles, indigo, madder, rice, sugar and opium. Most of these products were exported to Persia and Arabia wherefrom they found their way to other countries.

Local people consumed sorghum, peas, buffalo milk and fish as reported by Ibn Battutta while in Sindh in 1333 AD. Poppy for opium was raised around Manchar Lake.

"Climatic Optimum" continued up to about 1180 or 1200 AD and soon cold period started with low rain fall and low river level. Final drying up of Hakra may be due to climatic changes causing less spill water from the Sutlej and the Indus to Hakra. Low level of water in the river led to very small changes in the course of the River Indus, which remained stable between Hala and Koree Creek via Oderolal, Nasarpur, Shaikh Bhirkio, Matli, Badin, Kadhan, Lowari etc., for about five centuries. The dry climate caused troubles for Soomras after 1250 AD or latest by 1300 AD as it became worse around this time. Consequently soon after 1333 AD Sammas established themselves in the northern Sindh. After 1351 AD Sammas finally overthrew Soomras. To usurp their lands they forced upon the Soomras the jobs of artisan classes considered menial work in South Asia – turning them into carpenters, black-smiths, pottery makers, hair dressers, brick layers, masons, painters and etc. They usurped their lands because canals could not irrigate all the lands as they did during the "Climatic Optimum". Every time a major river change took place it deserted canals and rebellions started. The government was changed; the winners assigned themselves the primary means of production i.e., land and water and ousted the losers. Sammas did this to Soomras; Talpurs did the same to Kalhoras and their supporters.

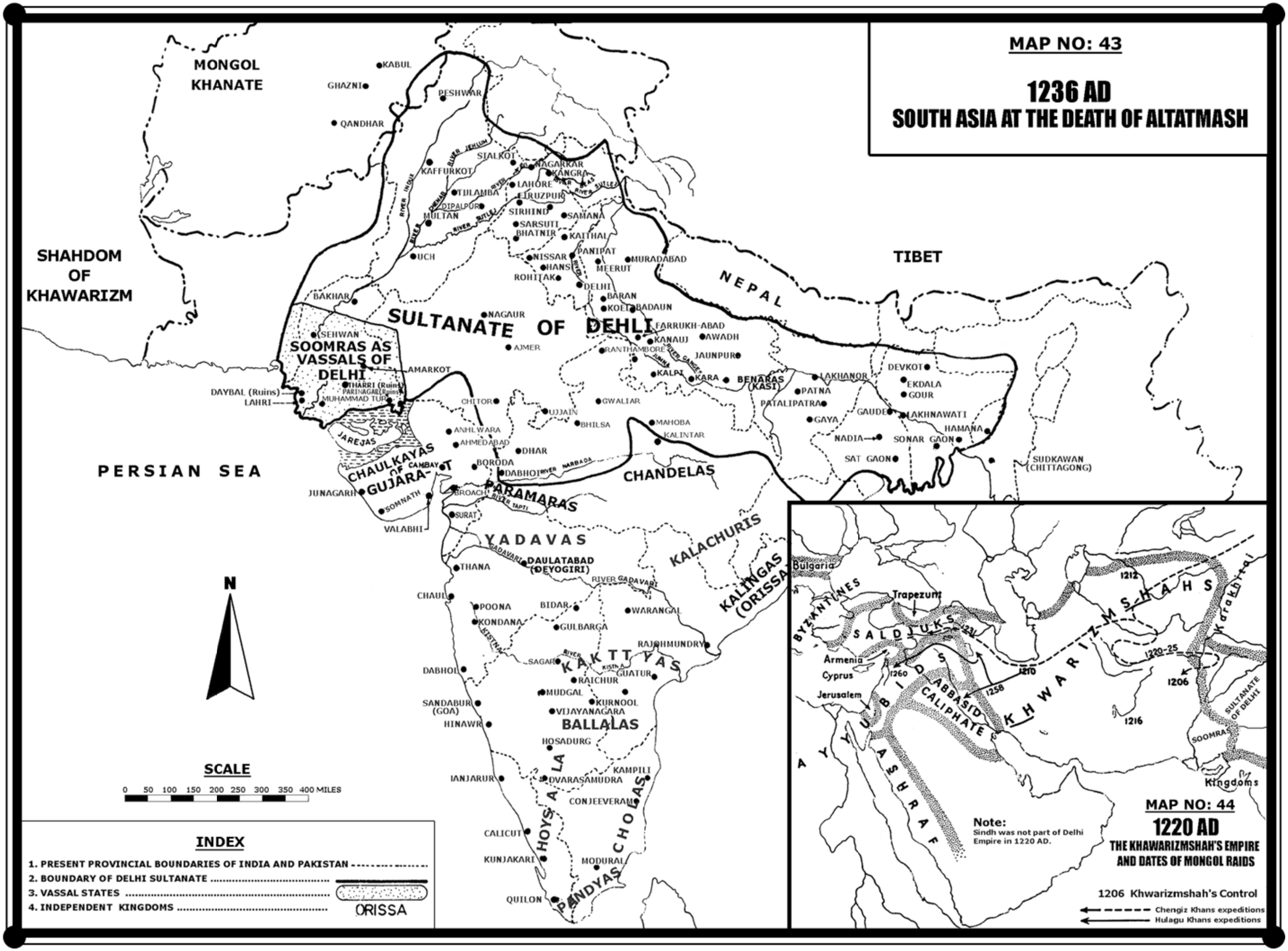
Two pieces of textiles of this period have survived. They are presumed to be of Gujarat origin, but their designs show affinities with the present textile designs of Sindh.

The crops grown in Sindh were: wheat, rice, oil seeds, pulses, sorghum, millets and barley as grain crops. Sugarcane was grown on the western branch of the Indus in the present Dadu and Larkana districts. Among fruits were: mango, orange, jammon (syzinum cumini), ber (zizyphus rotandifolia and mauritania), ginger, camphor, saffron, jero, aloe vera and some medicinal herbs. Vegetables were also grown on some scale.

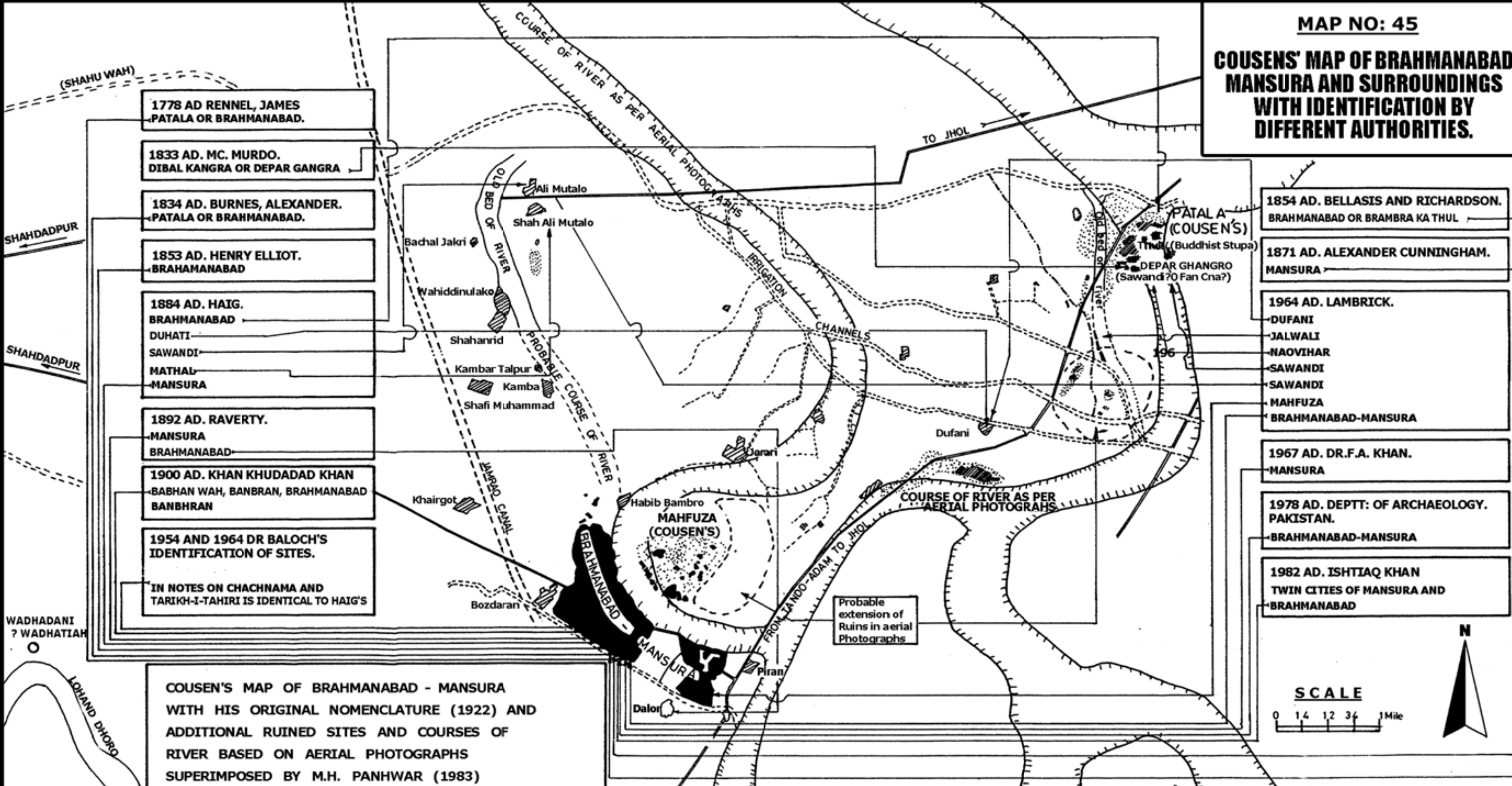


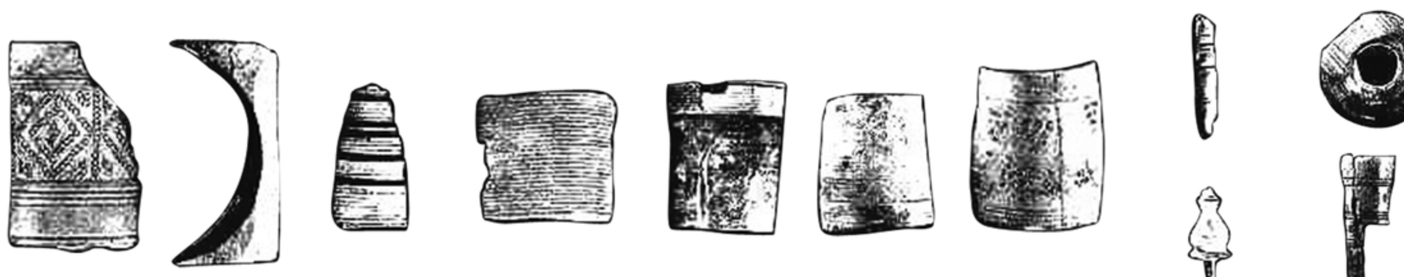
TERRACOTTA POTTERU MOULDS

794. Terracotta pottery moulds considred to be pre-Islamic but similar patterns also occur in Soomra period and later tiles and therefore the art has links with Soomra period. (Pakistan Archaeology No.1,1964).



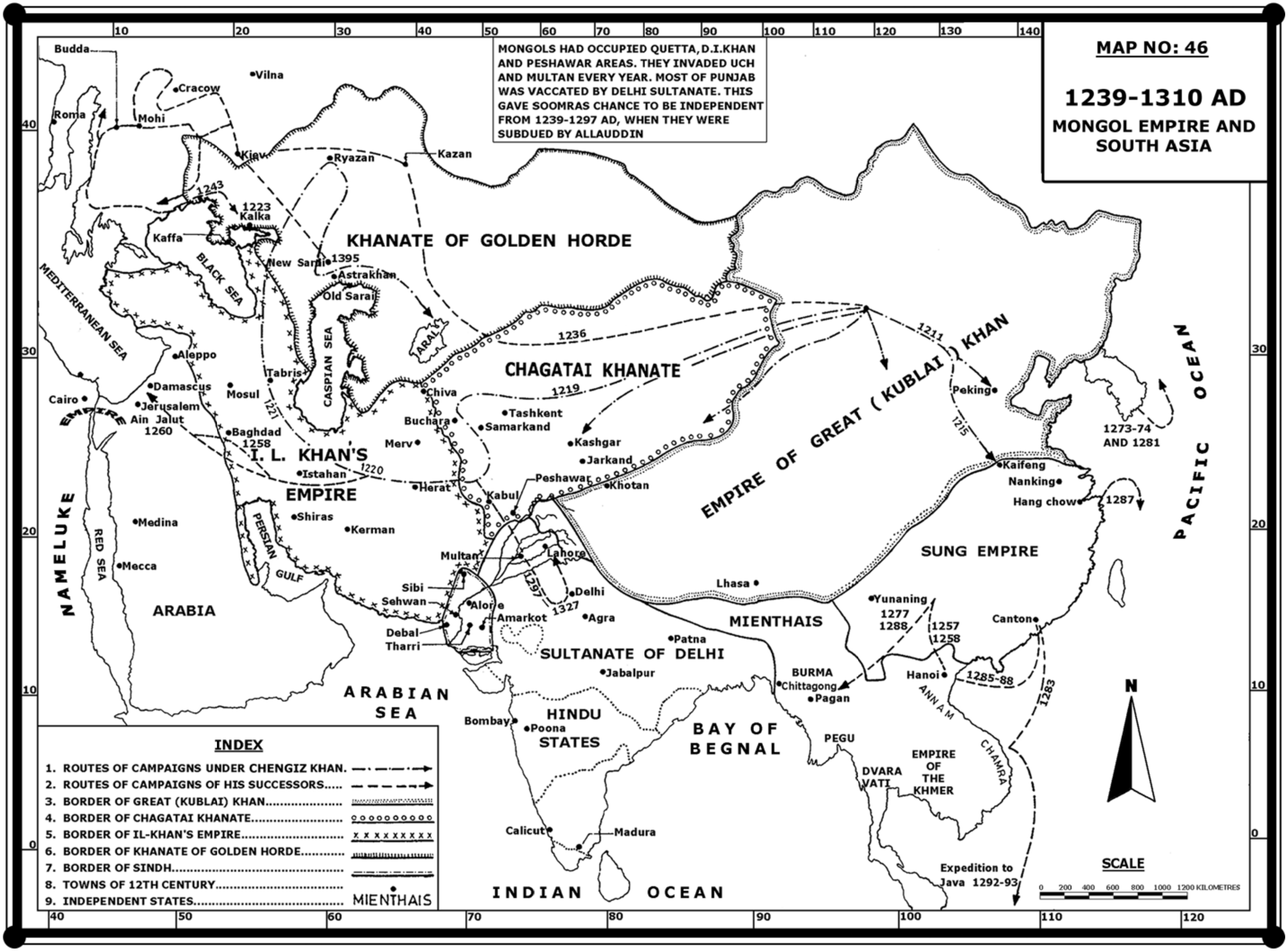
MAP NO: 43
1236 AD
SOUTH ASIA AT THE DEATH OF ALTATMASH
MONGOL KHANATE
SHAHDOM OF KHAWARIZM
TIBET
NEPAL
SULTANATE OF DEHLI
SOOMRAS AS VASSALS OF DELHI
PERSIAN SEA
CHAULKAYAS OF GUJARAT
JAREJAS
PARAMARAS
CHANDELAS
YADAVAS
KALACHURIS
KALINGAS (ORISSA)
KAKTTYAS
BALLALAS
HOYSALA
CHOLAS
PANDYAS
KABUL
GHAZNI
QANDHAR
PESHWAR
SIALKOT
NAGARKAR
KANGRA
KAFFURKOT
LAHORE
TULAMBA
FIRUZPUR
DIPALPUR
SIRHIND
MULTAN
SAMANA
SARSUTI
BHATNIR
KAITHAL
UCH
NISSAR
PANIPAT
HANSI
MURADABAD
MEERUT
ROHTAK
DELHI
BARAN
KOEL
BADAUN
BAKHAR
NAGAUR
FARRUKH-ABAD
SEHWAN
KANAUJ
AWADH
AJMER
RANTHAMBORE
JAUNPUR
AMARKOT
KALPI
KARA
BENARAS (KASI)
LAKHANOR
DEVKOT
EKDALA
GOUR
DAYBAL (Ruins)
THARRI (Ruins)
PARINAGAR (Ruins)
MUHAMMAD TUR
LAHRI
CHITOR
GWALIAR
UJJAIN
PATNA
PATALIPATRA
GAUDE
LAKHNAWATI
BHILSA
MAHOBA
GAYA
HAMANA
ANHLWARA
AHMEDABAD
KALINTAR
NADIA
SONAR GAON
DHAR
SUDKAWAN (CHITTAGONG)
BORODA
CAMBAY
DABHOI
SAT GAON
JUNAGARH
SOMNATH
BROACH
SURAT
VALABHI
THANA
DAULATABAD (DEVOGIRI)
CHAUL
POONA
BIDAR
WARANGAL
KONDANA
GULBARGA
RAJAHMUNDRY
SAGAR
DABHOL
RAICHUR
GUATUR
MUDGAL
KURNOOL
SANDABUR (GOA)
VIJAYANAGARA
HINAWR
HOSADURG
IANJARUR
KAMPILI
DVARASAMUDRA
CONJEEVERAM
CALICUT
KUNJAKARI
MODURAI
QUILON
RIVER INDUS
RIVER JEHLUM
RIVER CHENAB
RIVER RAVI
RIVER BEAS
RIVER SUTLEJ
RIVER JUMNA
RIVER GANGES
RIVER NARBADA
RIVER TAPTI
GADAVARI
RIVER GADAVARI
KISTNA
N
SCALE
0 50 100 150 200 250 300 350 400 MILES
INDEX
1. PRESENT PROVINCIAL BOUNDARIES OF INDIA AND PAKISTAN
2. BOUNDARY OF DELHI SULTANATE
3. VASSAL STATES
4. INDEPENDENT KINGDOMS
ORISSA
MAP NO: 44
1220 AD
THE KHAWARIZMSHAH'S EMPIRE AND DATES OF MONGOL RAIDS
KHWARIZMSHAHS
Karakhitai
SALDJUKS
BYZANTINES
AYYUBIDS
ABBASID CALIPHATE
ASHRAF
Bulgaria
Trapezunt
Armenia
Cyprus
Jerusalem
SULTANATE OF DELHI
SOOMRAS
Kingdoms
1212
1220-25
1206
1210
1258
1260
1216
Note:
Sindh was not part of Delhi Empire in 1220 AD.
1206 Khwarizmshah's Control
Chengiz Khans expeditions
Hulagu Khans expeditions

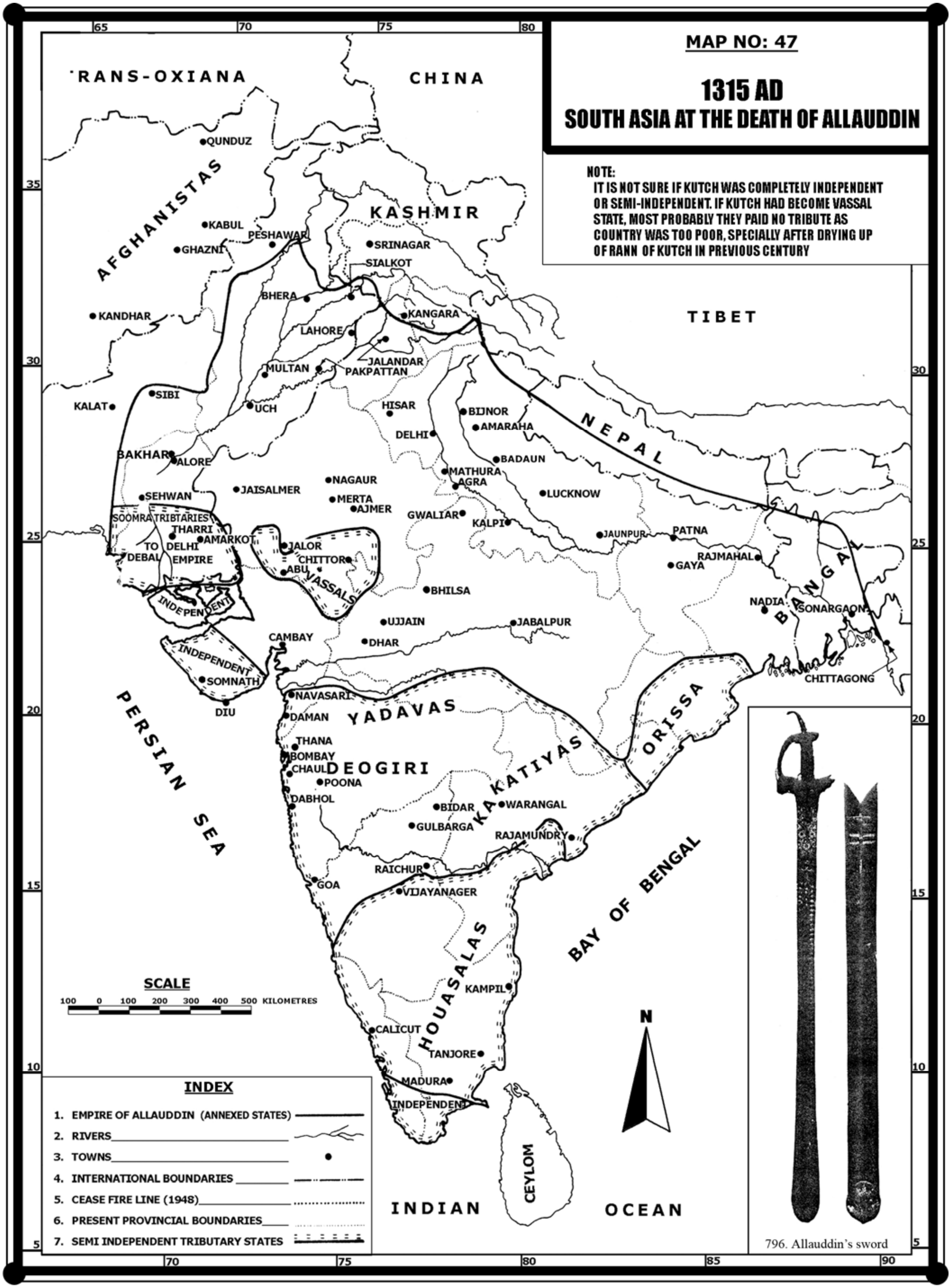




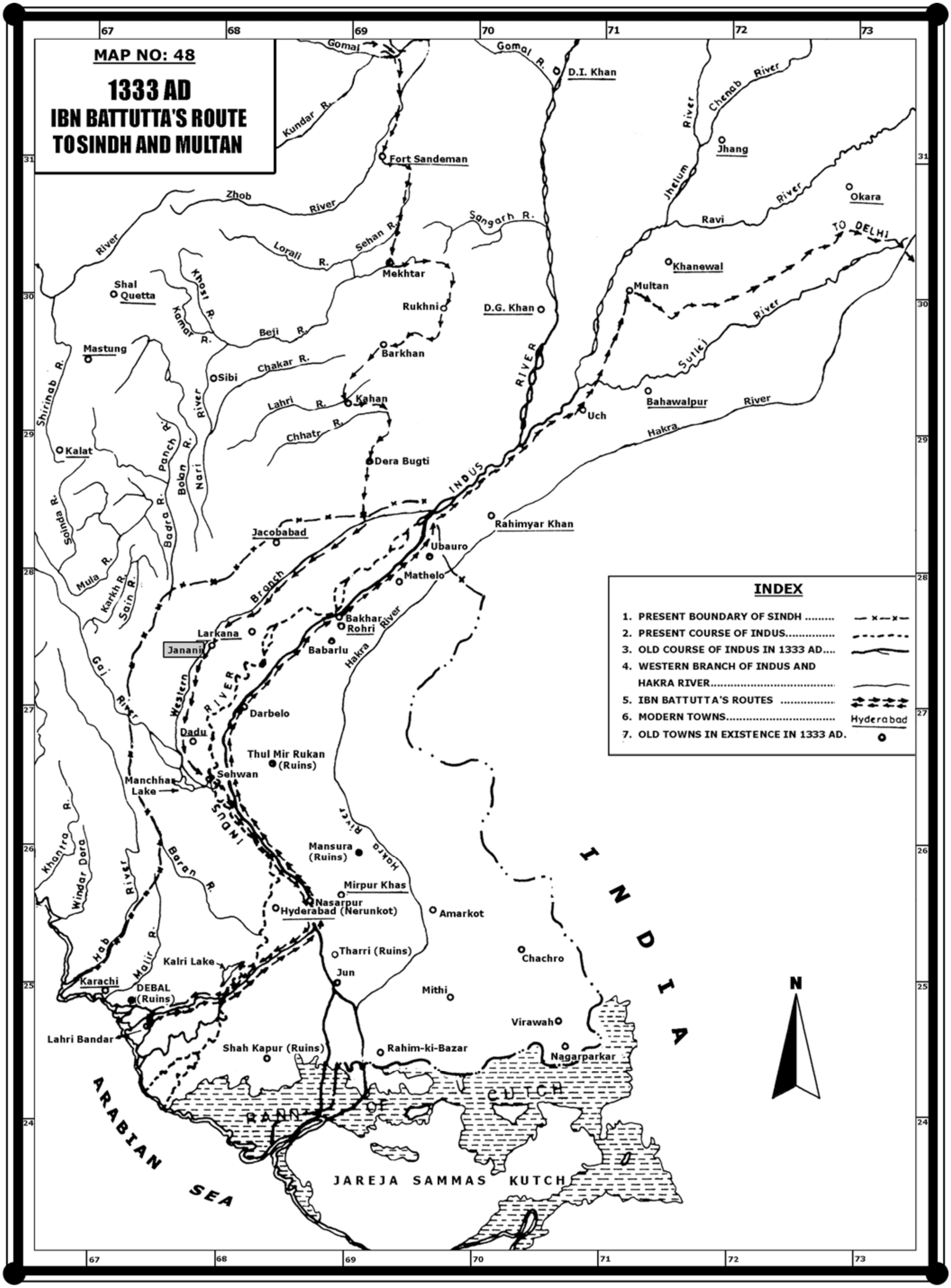
IVORY OBJECTS

795. Ivory objects from Banbhore

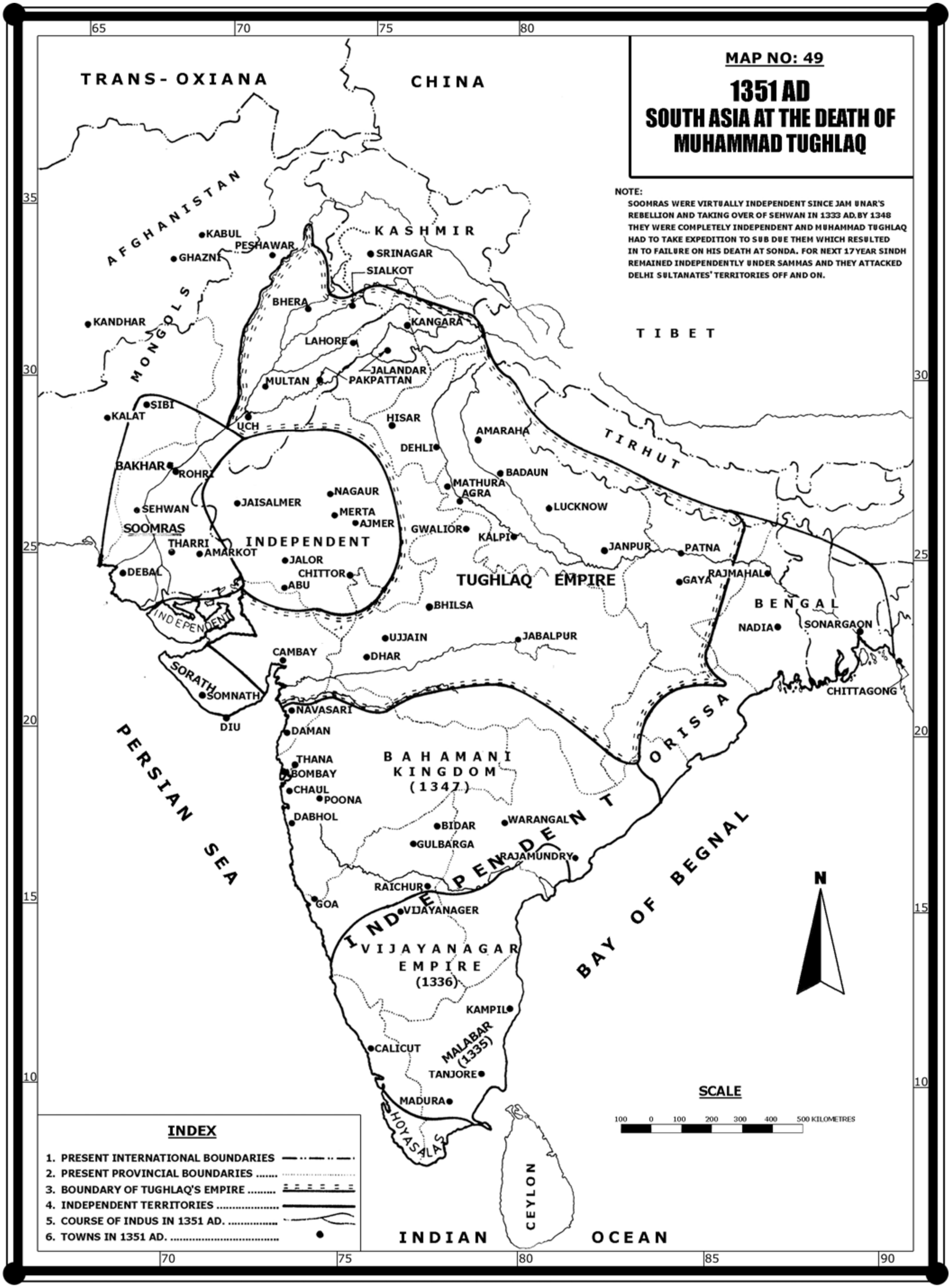

MAP NO: 46
1239-1310 AD
MONGOL EMPIRE AND SOUTH ASIA
MONGOLS HAD OCCUPIED QUETTA, D.I.KHAN AND PESHAWAR AREAS. THEY INVADED UCH AND MULTAN EVERY YEAR. MOST OF PUNJAB WAS VACCATED BY DELHI SULTANATE. THIS GAVE SOOMRAS CHANCE TO BE INDEPENDENT FROM 1239-1297 AD, WHEN THEY WERE SUBDUED BY ALLAUDDIN
KHANATE OF GOLDEN HORDE
CHAGATAI KHANATE
EMPIRE OF GREAT (KUBLAI) KHAN
I. L. KHAN'S EMPIRE
SUNG EMPIRE
SULTANATE OF DELHI
HINDU STATES
MIENTHAIS
NAMELUKE EMPIRE
ARABIA
EMPIRE OF THE KHMER
DVARA VATI
PEGU
BURMA
ANNAM
CHAMRA
ARABIAN SEA
BAY OF BEGNAL
INDIAN OCEAN
PACIFIC OCEAN
MEDITERRANEAN SEA
BLACK SEA
CASPIAN SEA
ARAL
RED SEA
PERSIAN GULF
Budda
Roma
Mohi
Cracow
Vilna
Kiev
Ryazan
Kazan
Kaffa
1243
1223
Kalka
New Sarai
1395
Astrakhan
Old Sarai
Tabris
1221
Aleppo
Damascus
Jerusalem
Ain Jalut
1260
Cairo
Mosul
Baghdad
1258
Istahan
1220
Shiras
Kerman
Medina
Mecca
Chiva
Buchara
Merv
Herat
Tashkent
Samarkand
1236
1219
Kashgar
Jarkand
Khotan
Peshawar
Kabul
Multan
Lahore
Sibi
Sehwan
Alore
Amarkot
Debal
Tharri
1297
1327
Delhi
Agra
Patna
Jabalpur
Bombay
Poona
Calicut
Madura
Lhasa
1211
Peking
1215
Kaifeng
Nanking
Hang chow
1287
1273-74
AND 1281
Yunaning
1277
1288
1257
1258
Canton
Hanoi
1285-88
1283
Chittagong
Pagan
Expedition to Java 1292-93
N
SCALE
0 200 400 600 800 1000 1200 KILOMETRES
INDEX
1. ROUTES OF CAMPAIGNS UNDER CHENGIZ KHAN.
2. ROUTES OF CAMPAIGNS OF HIS SUCCESSORS.....
3. BORDER OF GREAT (KUBLAI) KHAN....................
4. BORDER OF CHAGATAI KHANATE.........................
5. BORDER OF IL-KHAN'S EMPIRE...........................
6. BORDER OF KHANATE OF GOLDEN HORDE...........
7. BORDER OF SINDH..
8. TOWNS OF 12TH CENTURY.....................................
9. INDEPENDENT STATES...
MIENTHAIS



796. Allauddin's sword



MAP NO: 48
1333 AD
IBN BATTUTTA'S ROUTE
TO SINDH AND MULTAN
INDEX
1. PRESENT BOUNDARY OF SINDH
2. PRESENT COURSE OF INDUS
3. OLD COURSE OF INDUS IN 1333 AD
4. WESTERN BRANCH OF INDUS AND HAKRA RIVER
5. IBN BATTUTTA'S ROUTES
6. MODERN TOWNS
Hyderabad
7. OLD TOWNS IN EXISTENCE IN 1333 AD.
Gomal
Gomal R.
D.I. Khan
Kundar R.
Chenab River
River
Jhang
Fort Sandeman
Jhelum
Okara
Zhob
River
Ravi
River
Sangarh R.
TO DELHI
Lorali R.
Sehan R.
River
Mekhtar
Khanewal
Shal
Quetta
Khosi R.
Multan
Kamar R.
Rukhni
D.G. Khan
Beji R.
River
Mastung
Barkhan
Sutlej
Sibi
Chakar R.
RIVER
Shirinab R.
River
Lahri R.
Kahan
Bahawalpur
River
Uch
Chhatr R.
Hakra
Kalat
Panch R.
Bolan R.
Nari
Dera Bugti
INDUS
Soinda R.
Badra R.
Jacobabad
Rahimyar Khan
Ubauro
Mula R.
Karkh R.
Sain R.
Branch
Mathelo
Bakhar
Rohri
River
Larkana
Janani
Babarlu
Hakra
Gaj River
Western
RIVER
Darbelo
Dadu
Thul Mir Rukan
(Ruins)
Manchhar
Lake
Sehwan
INDUS
Hakra River
Khantra R.
Windar Dora
Hab River
Baran R.
Mansura
(Ruins)
INDIA
Mirpur Khas
Nasarpur
Hyderabad (Nerunkot)
Amarkot
Malir R.
Kalri Lake
Tharri (Ruins)
Chachro
Karachi
DEBAL
(Ruins)
Jun
Mithi
N
Virawah
Lahri Bandar
Shah Kapur (Ruins)
Rahim-ki-Bazar
Nagarparkar
ARABIAN SEA
RANN OF CUTCH
JAREJA SAMMAS KUTCH
67
68
69
70
71
72
73
31
30
29
28
27
26
25
24


MAP NO: 49
1351 AD
SOUTH ASIA AT THE DEATH OF MUHAMMAD TUGHLAQ
NOTE:
SOOMRAS WERE VIRTUALLY INDEPENDENT SINCE JAM UNAR'S REBELLION AND TAKING OVER OF SEHWAN IN 1333 AD, BY 1348 THEY WERE COMPLETELY INDEPENDENT AND MUHAMMAD TUGHLAQ HAD TO TAKE EXPEDITION TO SUB DUE THEM WHICH RESULTED IN TO FAILURE ON HIS DEATH AT SONDA. FOR NEXT 17 YEAR SINDH REMAINED INDEPENDENTLY UNDER SAMMAS AND THEY ATTACKED DELHI SULTANATES' TERRITORIES OFF AND ON.
TRANS-OXIANA
CHINA
AFGHANISTAN
KASHMIR
TIBET
MONGOLS
KABUL
PESHAWAR
GHAZNI
SRINAGAR
SIALKOT
KANDHAR
BHERA
KANGARA
LAHORE
JALANDAR
MULTAN
PAKPATTAN
SIBI
KALAT
UCH
HISAR
AMARAHA
DEHLI
TIRHUT
BAKHAR
ROHRI
BADAUN
MATHURA
AGRA
NAGAUR
JAISALMER
MERTA
AJMER
SEHWAN
LUCKNOW
SOOMRAS
GWALIOR
KALPI
INDEPENDENT
THARRI
AMARKOT
JANPUR
PATNA
JALOR
DEBAL
CHITTOR
TUGHLAQ EMPIRE
GAYA
RAJMAHAL
ABU
BENGAL
BHILSA
INDEPENDENT
NADIA
SONARGAON
UJJAIN
JABALPUR
CAMBAY
DHAR
SORATH
SOMNATH
CHITTAGONG
DIU
NAVASARI
ORISSA
DAMAN
PERSIAN SEA
BAHAMANI KINGDOM (1347)
THANA
BOMBAY
CHAUL
POONA
DABHOL
BIDAR
WARANGAL
GULBARGA
INDEPENDENT
RAJAMUNDRY
BAY OF BEGNAL
RAICHUR
GOA
VIJAYANAGER
N
VIJAYANAGAR EMPIRE (1336)
KAMPIL
CALICUT
MALABAR (1335)
TANJORE
MADURA
HOYASALAS
CEYLON
INDIAN OCEAN
SCALE
100 0 100 200 300 400 500 KILOMETRES
INDEX
1. PRESENT INTERNATIONAL BOUNDARIES
2. PRESENT PROVINCIAL BOUNDARIES
3. BOUNDARY OF TUGHLAQ'S EMPIRE
4. INDEPENDENT TERRITORIES
5. COURSE OF INDUS IN 1351 AD.
6. TOWNS IN 1351 AD.
65 70 75 80 85 90
35 30 25 20 15 10

CLAY POTTERY PIECES FOUND BY BELASIS AND COUSENS FROM BRAHMANABAD-MANSURA IN 1854 EXCAVATIONS. SUBSEQUENT POTTERY OF SOOMRA (1011-1351) AND SAMMA (1351-1525) PERIODS SHOWS SIMILAR PATTERNS AND DESIGNS.

797

798

799

800

801

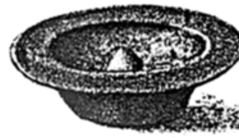
802

803

804

805

806



807

808

809

810

811

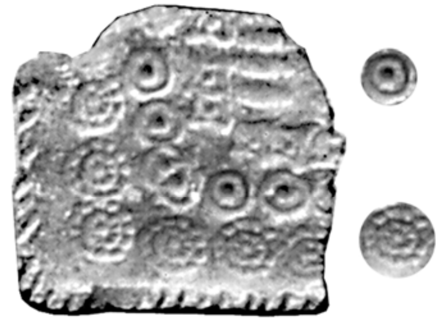
797. Water Jug with narrow belly and handle.
798. Tumbler or jug.
799. Tumbler.
800. Tumbler or jug.
801. Two handled decoratively painted jar with decorations similar to Indus culture pottery.
802. Hundi.
803. Tumbler.
804. Hundi.
805. Liquid storage jar with spout.
806. Liquid storage jar with narrow neck for suspension.
807. Lid.
808. Narrow mouth pot.
809. Dish for dessert.
810. Wine cup.
811. Lamp.

All sketches taken from Cousens orignal reports of Western Circle. Belasis's 23 sheets of drawings of Brahmanabad excavation, are in British India Office Library, London and could not be obtained for this publication.

ARTISTIC TILES AND BRICKS OF SOOMRA PERIOD

812

813



814

815

816

817

818

812. Sculptured decorative tile. It has a flower shaped circular pattern stamped at edges and two rows of triangular holes sculptured with knife or sharp tool with a triangular cutting edge similar to one used for cuneiform script. (LM).

813. Die cast tile. The designs resemble fig: no. 474 & 479 of ear ornaments. Patterns on it resemble design of ornaments of Pelo period. (LM).

814. Die cast tile with decorative design. Moulds are not of uniform size. It has two type of designs. Outer one has three circles, with hemispherical balls or beads arranged as 1,6 and 12 in each of three rows. The other also has three circles with hemispherical flower in the centre, second circle is depressed and third circle a ring with small hemispherical balls or beads. The edges of tile are sculptured with a knife to produce triangular patterns. (LM).

815. Die cast tile. (LM).

816. Highly decorative die cast tile. The design can be considered as having three large circles, central and out side sunken and middle raised. The out side circle has design in form of beads common in ear and nose ornaments of era. The circles have raised rectangular border and to fill space between borders, two circles are sunken, with small hole in the centre depicting eyes. The raised border is sculptured with series of crosses by a sharp knife. Max.L.9.3 cms. W. 6.9 cms. T.2.8 cms. Depth of pattern 1.2 cm. (SM).

817. Sculptured tile with sunken crosses and squares. (LM).

818. Die cast decorative tile with solar disc having two circles of beads; inner circle with 6 beads, outer circle with 18 beads. Beads are protected by raised rims. Discs are connected with stems and leaves. Leaves also have four rows of beads. It has been reproduced on Sindhi Ajrak. (SM).

ARTISTIC TILES AND BRICKS OF SOOMRA PERIOD

819

820

822

821

819. Die cast tile has four floral patterns drawn very accurately possibly on stone mould. It is highly accurate and drawn by artist with the help of good geometrical instruments, used by modern engineers from eighteenth to twentieth centuries. L.23.5 cms. W.15.25cms. T.4.25 cms. (SM).

820. Sculptured tile with triangles, squares and crosses. The sqaure and rectangles have been sculptured with knife and they are not of uniform size and bottom portion is rough. Thickness 3-4 cms, Max.L.18.4 cms. Max.W.9.1 cms. (SM).

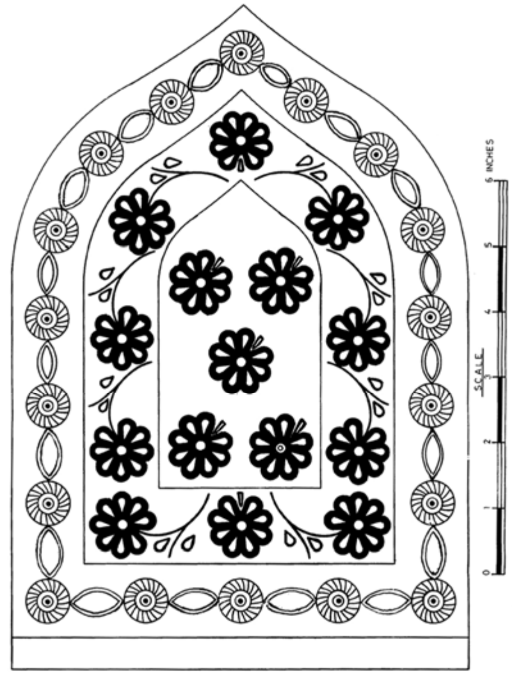
821. Drawing of die cast tile. It is a tile having floral design with eight petals. Flowers are laid diagonally in a rectangle in five lines as 1,3, 4,3 and I flowers in each of five lines, but spacing of rectangles from each other is not uniform. Flowers are delicately provided with 8 leaves all uniformly of same size. L. 25.4 cms. W.18.4 cms. T.4.25 cms. (SM).

822. Decorative die-cast tile for interior or exterior decoration. It has two patterns, one embossed or raised and other too raised but has six petal flower sunken. (SM).

ARTISTIC TILES AND BRICKS OF SOOMRA PERIOD

Origin of die cast stamped and sculptured tiles and bricks in Sindh goes back to antiquity. Knife cut bricks have been found at Mohenjo Daro and such bricks and tiles have been unearthed from Kahujo Daro and Sudheranjo Daro Buddhist stupas. Sculpturing was done while brick was still wet. The job was delicate, artistic and time-consuming. It is no longer being practised, due to heavy influence of Delhi Sultanate and Mughal architectural methods, which were again borrowings from Iran and central Asia. The die cast tiles have designs, which were copy of ear and nose ornaments from neighouring countries and some designs are illustrated to show similarities. Die cast tiles had many floral designs going back to 6th century and this art continued being practised until early 16th century. Fig. no. 498 to 513 are tiles of the period.

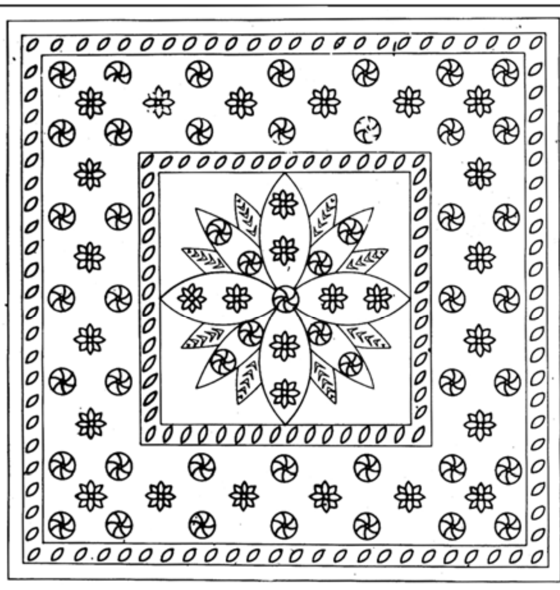
823



824

825

826



827

823. Die cast tile probably for religious purposes used in mosques or graves. It has extremely beautiful floral pattern and figure attached shows the details. The 8 petal flower is not South Asian lily. At the border other circles are divided in-to inner and outer circles with different designs. The workmanship is highly artistic and wooden mould surface must have either metallic dies fixed to it or it maybe a design engraved in stone to form bottom of brick mould. W.18.03 cms. H. 25.4 cms. L. up to shoulders 20.3 cms. T.8.2 cms. (SM).

824. Tile of Soomra period, a reconstruction. It is drawing of tile 498 by the author to show the high standard of workmanship. (MHP).

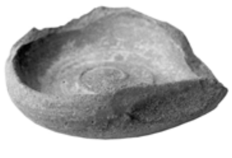
825. Die cast tile or notched tile. It has die cast flowers at one end and knife sculptured patterns at other end. Edges are notched with knife to produce triangular patterns. FLowers are shown separately. (LM).

826. Die cast block for special decoration of parapit walls of houses or graves and mosques. (LM).

827. Tile of Soomra period, a reconstruction by the author. The square tile has four designs of leaves and flowers die cast uniformly in fifteen rows. To separate the rows four squares are drawn with sharp tool manually. In the centre the circular flowers are arranged on sixteen leaves of three different sizes. Workmanship is of excellent quality. The original is in Sindh Museum. (MHP).

LIGHTING

Light is necessary to work in dark. Man has used wood and fat fire for various purposes including lighting since mid-Pleistocene. After start of Neolithic and production of vegetable oil, wick lamps burning oil in terracotta lamps became common. Same types and designs are fabricated even today, as was used at Kot Dijji and Mohenjo Daro. On special occasions multi-wick lamps are still used. A five-wick lamp was unearthed from Kot Dijji and is similar to four-wick lamp of Soomra era.



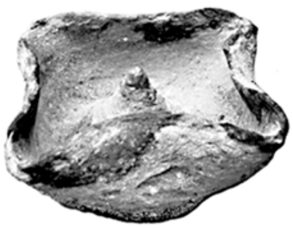
828

829

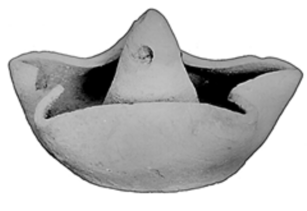
830

831

832



833



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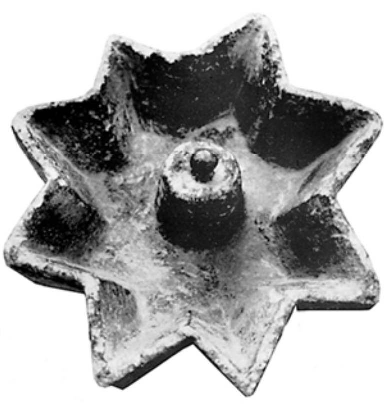


837

828. Small finely turned lamp from Shah Kapoor. Such lamps are in use today by disciples of some dead persons, on whose grave they lit token lamps, with small quantity of oil, good for an hour or less. (US).

829. 4-wick oil lamp with recessed hole in the bottom for straight or angled handle to carry it around. (LM).

830. Metallic wick lamp on stand. (BM).

831. Same as 830 on different stand.

832. 4-wick lamp with small hole at bottom for handle or peg. (LM).

833. Same as 832 .

834. 5-wick lamp from Kot Dijji (3000 BC), with arrangement to fix wooden rod at bottom to carry or mount it on a peg. Tradition countinues to this day. (SM).

835. Terracotta oil wick lamp. Max W. 9.4 cms. H. 9.4 cms. Dia. 7.35 cms. Bottom disc dia. 4.0 cms. (SN).

836. Garbo lamp, a decorative jar with wide holes. Similar jars were used in Gujarati Garbo dance with wick lamps or charcoal burning and flaming inside and throwing light outside. Women carried this on their heads and danced. H. 8.8 cms. Max dia at centre 7.85 cms. dia at mouth 4.4 cms. Some perforated jars from Mohenjo Daro called heaters could have served as lamp shade. (Marshall 1931, P1. LXXXIV-13, Mackay 1938,P1. LXII, 32 and P1. LXVII, 13) as shown in figures 5,6 & 7. They could not have served as Garbo lamps as their bottoms were also pierced. There are also small size perforated jars and they could not have been used as lamp shades (Marshall P1. LXXXIV, 1931 and Mackay P1. LXII, 1939. One pot (Mackay 1938,P1. LXVII) as shown in fig: no. 6, has wide mouth and can be kept above the lamp. (SM).

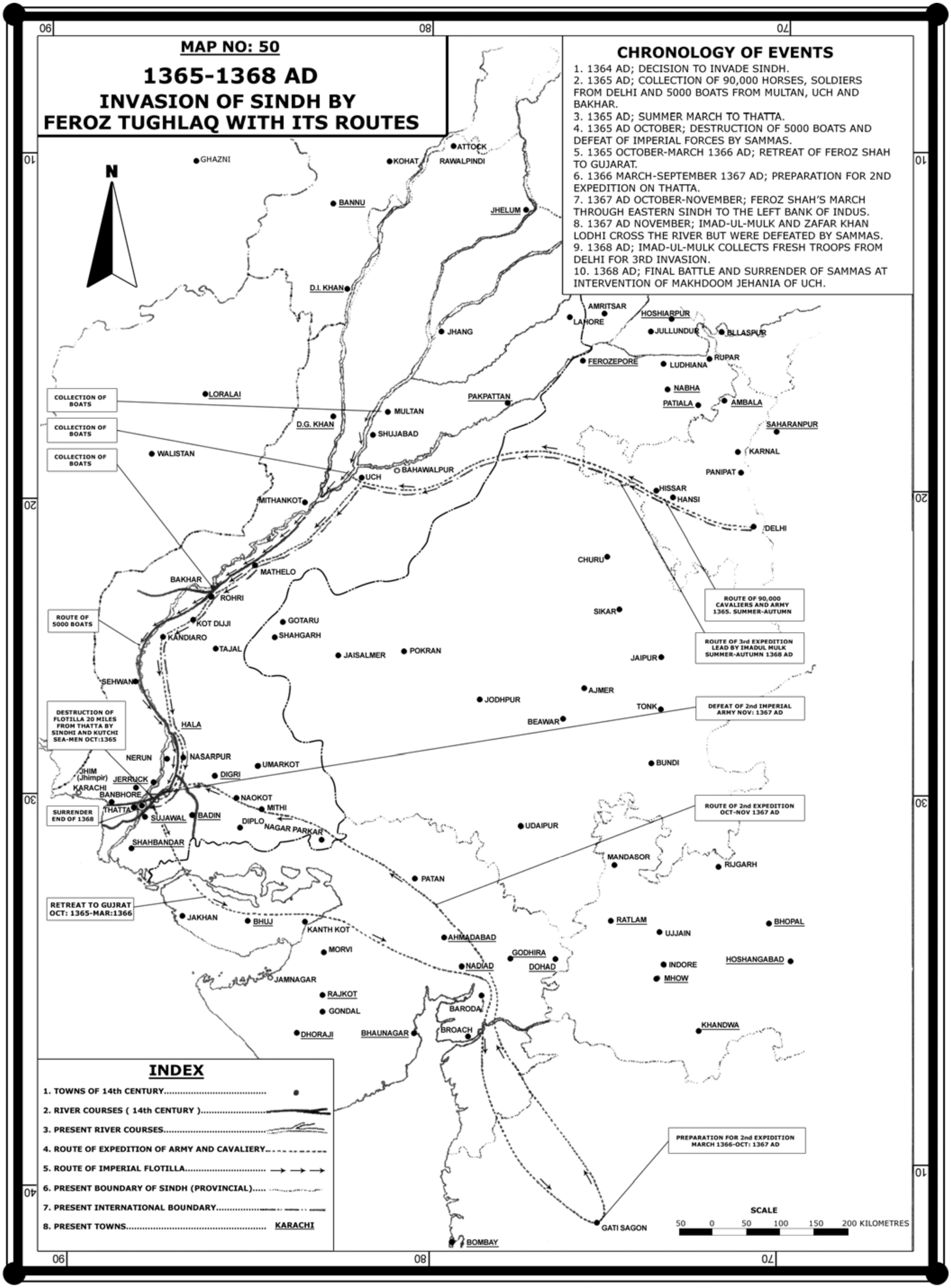
837. 8- wick brass lamp with brass knob for wire to suspend from roof or stand. Dia. 2.5 cms. H. 3.5 cms. (SM).

CHAPTER 25

IRRIGATION UNDER SAMMAS; 1351 - 1522 AD

Sammas displaced Soomras in 1351/52 AD. They formed majority of population. Their first ruler Jam Unar a Delhi Sultanate's officer rebelled in 1335 AD, killed governor of Sehwan, looted treasury and took shelter with his tribe escaping any punishment. He defeated Hamir (Dodo) Soomro in a single battle and established his rule in 1351 AD. The following is chronology of their rulers:

S.No.	Name of ruler	Period in AD		
1.	Jam Unar (under aegis of Soomras up to 1351)	1333	-	1352
2.	Jam Juna-I	1352	-	1368
3.	Jam Banbhiniyo (joint with Juna)	1352	-	1368
4.	Jam Tamachi (joint with Togachi)	1368	-	1370
5.	Jam Juna-I (second time)	1371	-	1388/89
6.	Jam Tamachi (second time)	1389	-	1392
7.	Salahuddin	Short time		
8.	Jam Nizamuddin-I	1392	-	1404/05
9.	Jam Ali Sher	1404/05	-	1406/07
10.	Son of Jam Tamachi	1406/07	-	1412/13
11.	Karan	1412	-	1413
12.	Sadaruddin	Short time		
13.	Jam Sikandar	1412/13	-	
14.	Fateh Khan	1412/13	-	1428
15.	Tughlaq (Inscription)	1428	-	1453
16.	Mubarak	1453	-	
17.	Sikandar-II	1453	-	1454
18.	Sanjar	Short time		
19.	Rayadhan	1454	-	1461
20.	Jam Nando (Jam Nizamuddin-II)	1461	-	1508
21.	Feroz	1508	-	1522


MAP NO: 50
1365-1368 AD
INVASION OF SINDH BY
FEROZ TUGHLAQ WITH ITS ROUTES
CHRONOLOGY OF EVENTS
1. 1364 AD; DECISION TO INVADE SINDH.
2. 1365 AD; COLLECTION OF 90,000 HORSES, SOLDIERS FROM DELHI AND 5000 BOATS FROM MULTAN, UCH AND BAKHAR.
3. 1365 AD; SUMMER MARCH TO THATTA.
4. 1365 AD OCTOBER; DESTRUCTION OF 5000 BOATS AND DEFEAT OF IMPERIAL FORCES BY SAMMAS.
5. 1365 OCTOBER-MARCH 1366 AD; RETREAT OF FEROZ SHAH TO GUJARAT.
6. 1366 MARCH-SEPTEMBER 1367 AD; PREPARATION FOR 2ND EXPEDITION ON THATTA.
7. 1367 AD OCTOBER-NOVEMBER; FEROZ SHAH'S MARCH THROUGH EASTERN SINDH TO THE LEFT BANK OF INDUS.
8. 1367 AD NOVEMBER; IMAD-UL-MULK AND ZAFAR KHAN LODHI CROSS THE RIVER BUT WERE DEFEATED BY SAMMAS.
9. 1368 AD; IMAD-UL-MULK COLLECTS FRESH TROOPS FROM DELHI FOR 3RD INVASION.
10. 1368 AD; FINAL BATTLE AND SURRENDER OF SAMMAS AT INTERVENTION OF MAKHDOOM JEHANIA OF UCH.
N
GHAZNI
KOHAT
ATTOCK
RAWALPINDI
BANNU
JHELUM
D.I. KHAN
JHANG
AMRITSAR
LAHORE
HOSHIARPUR
JULLUNDUR
BILASPUR
FEROZEPORE
LUDHIANA
RUPAR
LORALAI
COLLECTION OF BOATS
COLLECTION OF BOATS
COLLECTION OF BOATS
MULTAN
PAKPATTAN
NABHA
PATIALA
AMBALA
D.G. KHAN
SHUJABAD
SAHARANPUR
WALISTAN
BAHAWALPUR
KARNAL
UCH
PANIPAT
HISSAR
HANSI
MITHANKOT
DELHI
CHURU
MATHELO
BAKHAR
ROHRI
ROUTE OF 90,000 CAVALIERS AND ARMY 1365. SUMMER-AUTUMN
SIKAR
ROUTE OF 5000 BOATS
KOT DIJI
GOTARU
SHAHGARH
KANDIARO
TAJAL
JAISALMER
POKRAN
ROUTE OF 3rd EXPEDITION LEAD BY IMADUL MULK SUMMER-AUTUMN 1368 AD
JAIPUR
SEHWAN
AJMER
JODHPUR
TONK
DESTRUCTION OF FLOTILLA 20 MILES FROM THATTA BY SINDHI AND KUTCHI SEA-MEN OCT:1365
HALA
BEAWAR
DEFEAT OF 2nd IMPERIAL ARMY NOV: 1367 AD
NERUN
NASARPUR
UMARKOT
BUNDI
JHIM (Jhimpir)
JERRUCK
DIGRI
KARACHI
BANBHORE
NAOKOT
ROUTE OF 2nd EXPEDITION OCT-NOV 1367 AD
THATTA
MITHI
SURRENDER END OF 1368
SUJAWAL
BADIN
DIPLO
NAGAR PARKAR
UDAIPUR
SHAHBANDAR
MANDASOR
RIJGARH
PATAN
RETREAT TO GUJRAT OCT: 1365-MAR:1366
JAKHAN
BHUJ
KANTH KOT
RATLAM
BHOPAL
UJJAIN
AHMADABAD
MORVI
GODHIRA
DOHAD
NADIAD
INDORE
HOSHANGABAD
MHOW
JAMNAGAR
RAJKOT
BARODA
GONDAL
DHORAJI
BHAUNAGAR
BROACH
KHANDWA
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1. TOWNS OF 14th CENTURY
2. RIVER COURSES (14th CENTURY)
3. PRESENT RIVER COURSES
4. ROUTE OF EXPEDITION OF ARMY AND CAVALIERY
5. ROUTE OF IMPERIAL FLOTILLA
6. PRESENT BOUNDARY OF SINDH (PROVINCIAL)
7. PRESENT INTERNATIONAL BOUNDARY
8. PRESENT TOWNS
KARACHI
PREPARATION FOR 2nd EXPIDITION MARCH 1366-OCT: 1367 AD
GATI SAGON
BOMBAY
SCALE
50 0 50 100 150 200 KILOMETRES

It was during their rule that the Portuguese discovered sea route to south India in 1498 AD and for the next century were masters of all seas of the world. Portuguese was lingua franca at all ports of South Asia. Many Portuguese words entered Sindhi language due to their contacts for more than 150 years.

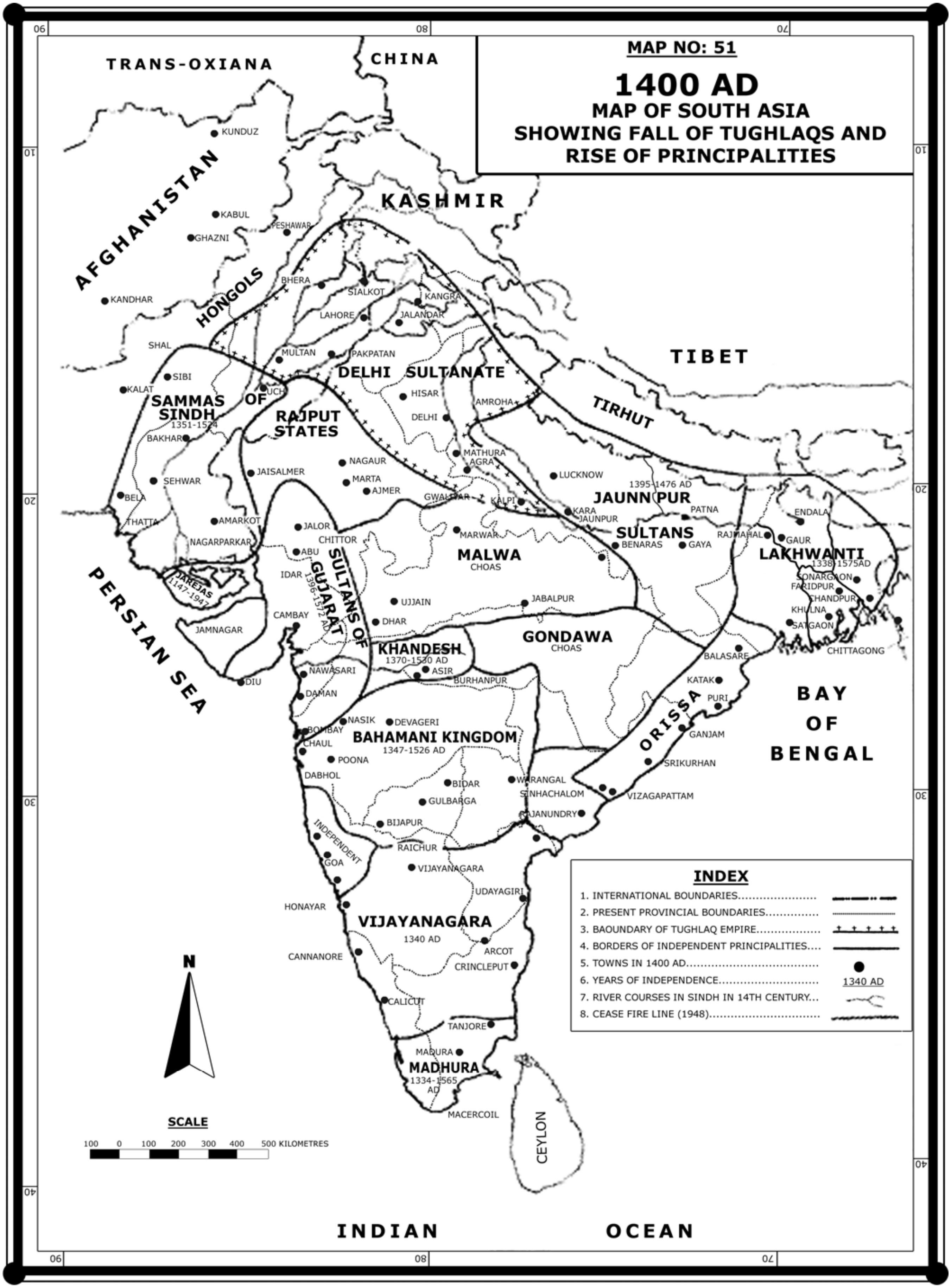
MILD CLIMATE (1300-1525 AD) AND SAMMA RULE

Under Sammas (1333-1522 AD) climate though arid was not too harsh. Although area under cultivation had decreased and so did the population yet it was not as severe as during the Jhukar, Jhangar or the Arab governors' period and therefore on taking over they were able to stabilise conditions and avoid even an initial period of turmoil.

The climate during Samma period was mild, rain fall was medium, the river levels were also medium and river maintained a stable course. In general the conditions were average. The climatic conditions remained unchanged throughout the world. The Delhi Sultanate under Tughlaqs had deteriorated due to dry conditions in the first half of the fourteenth century – the period that brought the down fall of Soomras too. Dry conditions in the central Asia in the whole thirteenth century, which had brought Mongol invasions and end of Abbasid Caliphate, had ultimately led to small Mongol principalities in the whole central Asia in the fourteenth century and they had been involved in petty feuds and rivalries among themselves. There was no power left either in the South Asia or in the central Asia to capture Sindh. Therefore it was peaceful during the fifteenth century.

Like Soomra period the direct evidence of irrigation system during the period is scanty, but sufficient indirect material available shows a well managed irrigation system thereby proving that no change in the course of the River Indus took place during the one-hundred-and-seventy-four years of their rule. One change that took place was that the Indus shot a western loop in the present Dadu district opposite to present Radhan railway station re-entering the river opposite to Bubak south of Talti. Northern Dadu district then could boast of three irrigational channels; the western branch, the main river to the east and the loop in between. The remnants of this channel are now shown by series of lakes Maha, Sutiaro, Jakhpari, Pir Ghunio, Talti and many other small ones. This made Baghban an important town and Sehwan Sarkar the richest area of the whole Sindh. A look at the map shows large concentration of towns in this Sarkar. Important persons like Darya Khan (Mubarak Khan), Makhdoom Bilawal and Mubarak (father of Abul Fazl and Faizi) were settled in that area. Richness of its irrigated agriculture attracted Arghoons to invade, conquer and settle. They attacked and looted Baghban a city at the heart of this area. The same area gave maximum resistance to Arghoons. The various canals existing in the period as described in five histories namely Tarkhan Namah, Tahiri, Mazhar Shah Jehani, Masumi and Beglar Namah are:

- Mir Abro a large canal in Chanduka Parguna (Larkana district) was excavated by Abro clan, which irrigated a large area. It may have been Ghar canal or a predecessor of it. It was very well managed as Mazhar Shah Jehani mentions it.
- Khan Wah was constructed by Darya Khan from the River Indus north of Thatta at the foot of hills for dual purpose of irrigating Sakro Parguna and defence of Thatta town. It must have been a very large canal running partly on the alignment of present Kalri canal as reported by Tarihk-i-Tahiri.
- Three Nais from the mountains Nari, Bhuri and Naing were converted by Darya Khan into a canal leading to the Manchar Lake. This canal irrigated lands in Nerun Parguna and revenue of rupees one hundred thousand accrued to government from it as reported in Mazhar Shah Jehani.
- Sawah or Saurah Wah was excavated to divert water from the hills (probably of the Gaj) by the Hindu vizier of Jam Nizamuddin named Chagla and Darya Khan. It irrigated an area in Bubak Parguna. It was thirty-eight miles from Sehwan as reported by Mazhar Shah Jehani.
- Kahi and Naing springs were also utilised for cultivation as Mazhar Shah Jehani states.
- Marui canal had its mouth from the Maha Lake (in Kakar taluka) and irrigated Deh Marui near the present Ibrahim Kachhi taluka Dadu as revealed by Mazhar Shah Jehani.
- Dadeji Wah called after village of the same name and flowing near village Nar irrigated an area in Bubak Parguna as mentioned in Mazhar Shah Jehani.
- Bolan Nai carrying water reached the Manchar Lake. Its waters were diverted by canals for irrigation. Two such canals; Sarwah and Moz


MAP NO: 51
1400 AD
MAP OF SOUTH ASIA
SHOWING FALL OF TUGHLAQS AND
RISE OF PRINCIPALITIES
TRANS-OXIANA
CHINA
AFGHANISTAN
KASHMIR
TIBET
TIRHUT
HONGOLS
DELHI SULTANATE
SAMMAS OF SINDH
1351-1524
RAJPUT STATES
JAUNN PUR SULTANS
1395-1476 AD
LAKHWANTI
1338-1575AD
MALWA
CHOAS
SULTANS OF GUJARAT
1396-1572 AD
JAREJAS
1147-1947
KHANDESH
1370-1530 AD
GONDAWA
CHOAS
BAHAMANI KINGDOM
1347-1526 AD
ORISSA
INDEPENDENT
VIJAYANAGARA
1340 AD
MADHURA
1334-1565 AD
CEYLON
PERSIAN SEA
BAY OF BENGAL
INDIAN OCEAN
KUNDUZ
KABUL
GHAZNI
PESHAWAR
KANDHAR
BHERA
SIALKOT
KANGRA
LAHORE
JALANDAR
SHAL
MULTAN
PAKPATAN
SIBI
KALAT
UCH
HISAR
AMROHA
DELHI
BAKHAR
MATHURA
AGRA
LUCKNOW
NAGAUR
JAISALMER
MARTA
AJMER
SEHWAR
BELA
GWALIAR
KALPI
KARA
JAUNPUR
PATNA
ENDALA
THATTA
AMARKOT
JALOR
MARWAR
BENARAS
GAYA
RAJMAHAL
GAUR
NAGARPARKAR
CHITTOR
ABU
IDAR
SONARGAON
FARIDPUR
CHANDPUR
KHULNA
SATGAON
CHITTAGONG
UJJAIN
JABALPUR
CAMBAY
DHAR
JAMNAGAR
NAWASARI
ASIR
BURHANPUR
BALASARE
DIU
DAMAN
KATAK
PURI
NASIK
DEVAGERI
BOMBAY
CHAUL
POONA
GANJAM
DABHOL
SRIKURHAN
BIDAR
WARANGAL
SINHACHALOM
VIZAGAPATTAM
GULBARGA
RAJANUNDRY
BIJAPUR
RAICHUR
GOA
VIJAYANAGARA
UDAYAGIRI
HONAYAR
ARCOT
CANNANORE
CRINCLEPUT
CALICUT
TANJORE
MADURA
MACERCOIL
N
SCALE
100 0 100 200 300 400 500 KILOMETRES
INDEX
1. INTERNATIONAL BOUNDARIES
2. PRESENT PROVINCIAL BOUNDARIES
3. BAOUNDARY OF TUGHLAQ EMPIRE
4. BORDERS OF INDEPENDENT PRINCIPALITIES
5. TOWNS IN 1400 AD
6. YEARS OF INDEPENDENCE
1340 AD
7. RIVER COURSES IN SINDH IN 14TH CENTURY
8. CEASE FIRE LINE (1948)

Wah irrigated Sibi and Gandava districts as reported by Mazhar Shah Jehani.

- Eastern Nara was dry then and was called in different names like Hakra, Wahind and Wahan etc., as Tarihk-i-Tahiri mentions.
- Beglar Namah gives a number of names of canals and lakes and mentions both by the same names i.e., Ab and Kolab. The lakes were filled in the inundation season and from them the Wahs (actually watercourses and minors) took their mouths. These canals and Kolabs were reported in existence ninety-five years after the fall of the Sammas. Their present locations are:
- Chaneja Wah in Thatta district.
- Sabzah Wah near Aghamani in Matli taluka.
- Katira Wah in Thatta district (on it were settled Ganhwar tribe).
- Nahan Wah on the Puran branch of the River Indus.
- Talao Sahta in Nawabshah district.
- Tarangchi Kolab in Nasarpur area.
- Tarabari Kolab in Nawabshah district.
- Jharani near Shah Garh fort in Nasarpur area.
- Ren Agham probably a canal in Matli taluka near Aghamani taking off from the Ren River.
- Saran Koalb in Badin district.
- Samarah Koalb or the Lake Samaro, which existed until recently.
- Ma'ahood Kolab in Samaro taluka.
- Pokhar Kolab in Badin taluka close to Puran.
- Lanbah Kolab (Lake Umerkot).
- Nahan Wah located either in Alore Parguna or on Puran near village Pur.
- Sapanah Wah four miles from Thatta.

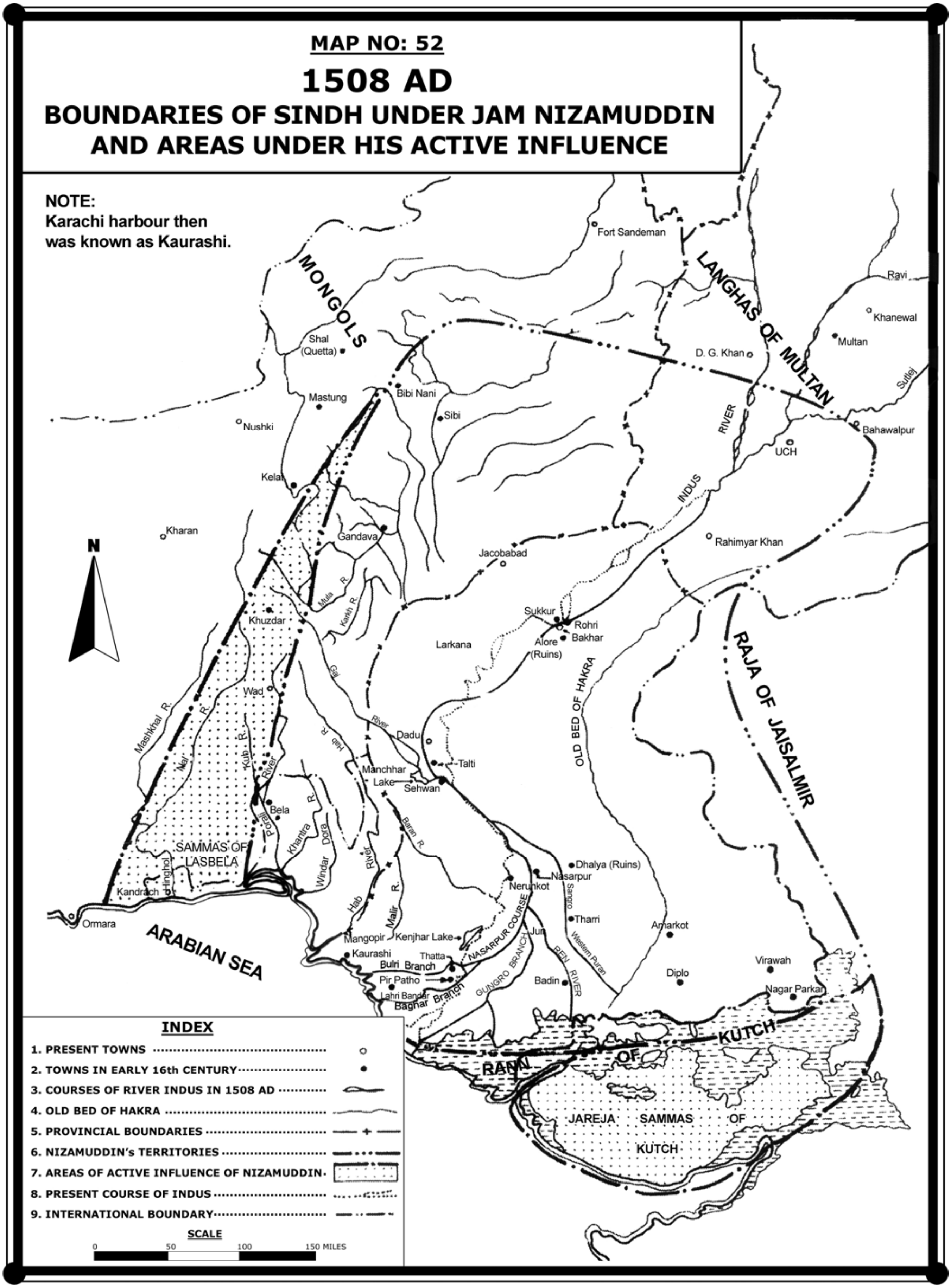
Since there was complete chaos in Sindh between 1522 and 1700 AD and the government was not able to function in the most of rural areas many canals of Kalhora period could be Samma canals.

Since the river had stabilised itself during the period the province became rich and prosperous. It also reached the climax of its political power under Jam Nizamuddin whose rule is unanimously praised by every historian of period. Under such peaceful conditions this small kingdom turned into benevolent state. The local language Sindhi also developed and most of early folklore in it was composed in the fifteenth century. Architecture was another cultural field in which great progress was made. Gujarati craftsmen incorporated many Hindu traits and patterns into Muslim religious architecture. Same trend developed in Sindh as is shown in the tomb of Jam Nizamuddin. Extensive irrigation contributes to increase in population. The area under cultivation in 1522 AD must have been minimum 1.6 million acres and population 2.4 millions.

By the end of fifteenth century (1498 AD) the Portuguese discovered the South Asia by sea route. They traded with Sindh in cotton, textiles and indigo – all the three irrigated agricultural products – and also saltpeter. Grains were also exported. The Portuguese introduced tobacco, pineapple, cashew, maize, sweet potato and papaya from America; lychee and sweet orange from China; peanut from Africa and Lal Mirch (red pepper) from Pernambuco in the sixteenth century. Some of these products were introduced in Sindh, but the date cannot be ascertained. The Portuguese and the other Europeans saw large communities in towns producing variety of textiles made of cotton, which was grown on irrigated lands in Sindh. Sugar, gums, glue, pepper and rice were the other products, which the Portuguese exported from Sindh. So great was the trade of Sindh that forty thousand boats could be hired on the Indus between Sehwan and Thatta as reported by Ain-i-Akbari written at the end of the sixteenth century. This fleet of forty thousand boats carried the goods and products of NWFP, Punjab, Kashmir, Afghanistan and even Sinkiang, Chitral, western Tibet and Sindh to the Lahri Bunder. Lahri Bunder came into being between 1228 and 1333 AD after burning of Debal by Khawarizm Shah of Iraq. Soon afterwards due to change in the course of the River Indus and drying up of Kalri branch a new port was established on the Baghar branch of the Indus called Lahri (لاڙي) or Lahri Bunder. Due to silting any port on the river was unstable and the sites of ports changed often. A number of sites claimed as this port are most probably all Lahri Bunders flourishing between thirteenth and seventeenth centuries. One of the sites occupies an extensive area and most probably had a Portuguese fort and church.

In this century the ships built in the South Asia were larger in size than European ships as reported by Nicolocoti. Some ships were built in compartments so that if one compartment was wrecked the destination could be reached on other compartments. During the century Gujarat became a great marine power. It is reported that Sultan Mahmud Begra maintained a great fleet to subdue pirates who infested his coast as reported by Elphinstone.

In the fifteenth and sixteenth centuries cotton textiles, printed cloth, calico, silk cloth, chintz and muslin were produced at Sukkur, Bakhar, Darbelo,


MAP NO: 52
1508 AD
BOUNDARIES OF SINDH UNDER JAM NIZAMUDDIN AND AREAS UNDER HIS ACTIVE INFLUENCE
NOTE:
Karachi harbour then was known as Kaurashi.
MONGOLS
LANGHAS OF MULTAN
RAJA OF JAISALMIR
SAMMAS OF LASBELA
JAREJA SAMMAS OF KUTCH
RANN OF KUTCH
ARABIAN SEA
Fort Sandeman
Ravi
Khanewal
Multan
Sutlej
Shal (Quetta)
D. G. Khan
Bibi Nani
Mastung
Sibi
Nushki
Bahawalpur
UCH
RIVER INDUS
Kelat
Kharan
Gandava
Jacobabad
Rahimyar Khan
Mula R.
Karkh R.
Khuzdar
Sukkur
Rohri
Bakhar
Alore (Ruins)
Larkana
Gaj River
OLD BED OF HAKRA
Wad
Mashkhal R.
Nal R.
Kub R.
Porali River
Hab R.
Dadu
Talti
Manchhar Lake
Sehwan
Bela
Khantra R.
Dora R.
Baran R.
Windar
Hinghol
Kandrach
Ormara
Hab River
Malir R.
Nerunkot
Nasarpur
Dhalya (Ruins)
Sangro
Tharri
Amarkot
Mangopir
Kenjhar Lake
NASARPUR COURSE
Jun
Kaurashi
Thatta
Bulri Branch
Pir Patho
Lahri Bandar
Baghar Branch
GUNGRO BRANCH
Badin
REN RIVER
Western Puran
Diplo
Virawah
Nagar Parkar
N
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1. PRESENT TOWNS
2. TOWNS IN EARLY 16th CENTURY
3. COURSES OF RIVER INDUS IN 1508 AD
4. OLD BED OF HAKRA
5. PROVINCIAL BOUNDARIES
6. NIZAMUDDIN's TERRITORIES
7. AREAS OF ACTIVE INFLUENCE OF NIZAMUDDIN
8. PRESENT COURSE OF INDUS
9. INTERNATIONAL BOUNDARY
SCALE
0 50 100 150 MILES

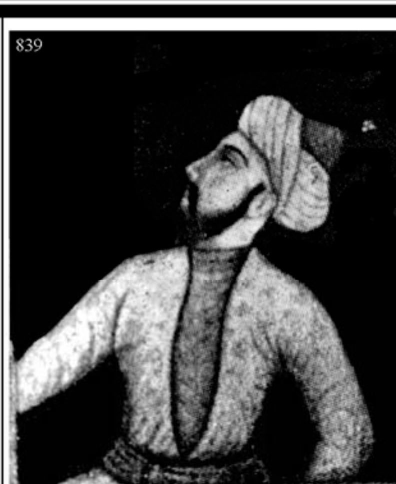
Kandiaro, Sehwan, Nasarpur and Thatta. At the last places Ajraks and Lungis were manufactured.

Articles of trade besides textiles were: Multani carpets, embroidery, leather goods, Kashmiri shawls, madder, timber from Kashmir and North West wood work, tents and tent cloth, saltpeter, indigo, frontier, cotton, wheat, opium, rice, sugar and grains. Imports were: silver, gold, metals, metal ware, glass, porcelain, horses, spices, gum, glue, perfumes, unguents, cosmetics, preservatives, waxes, aromatics, condiments, pepper (red, white and black), capsicum and cinnamon.

The prosperity of the period is clear from the architecture of Samma period at Makli Hill near Thatta, specially stone carvings in Jam Nizamuddin and Darya Khan’s tombs. Hammad Jamali's Khanqah and a mosque at Makli also show high standards of workmanship.

838

839



840

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842

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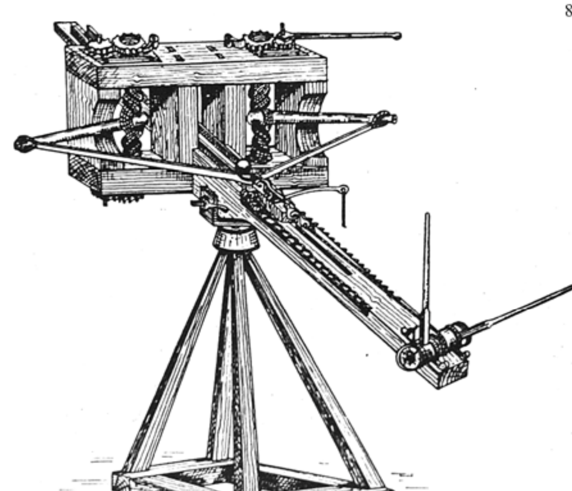
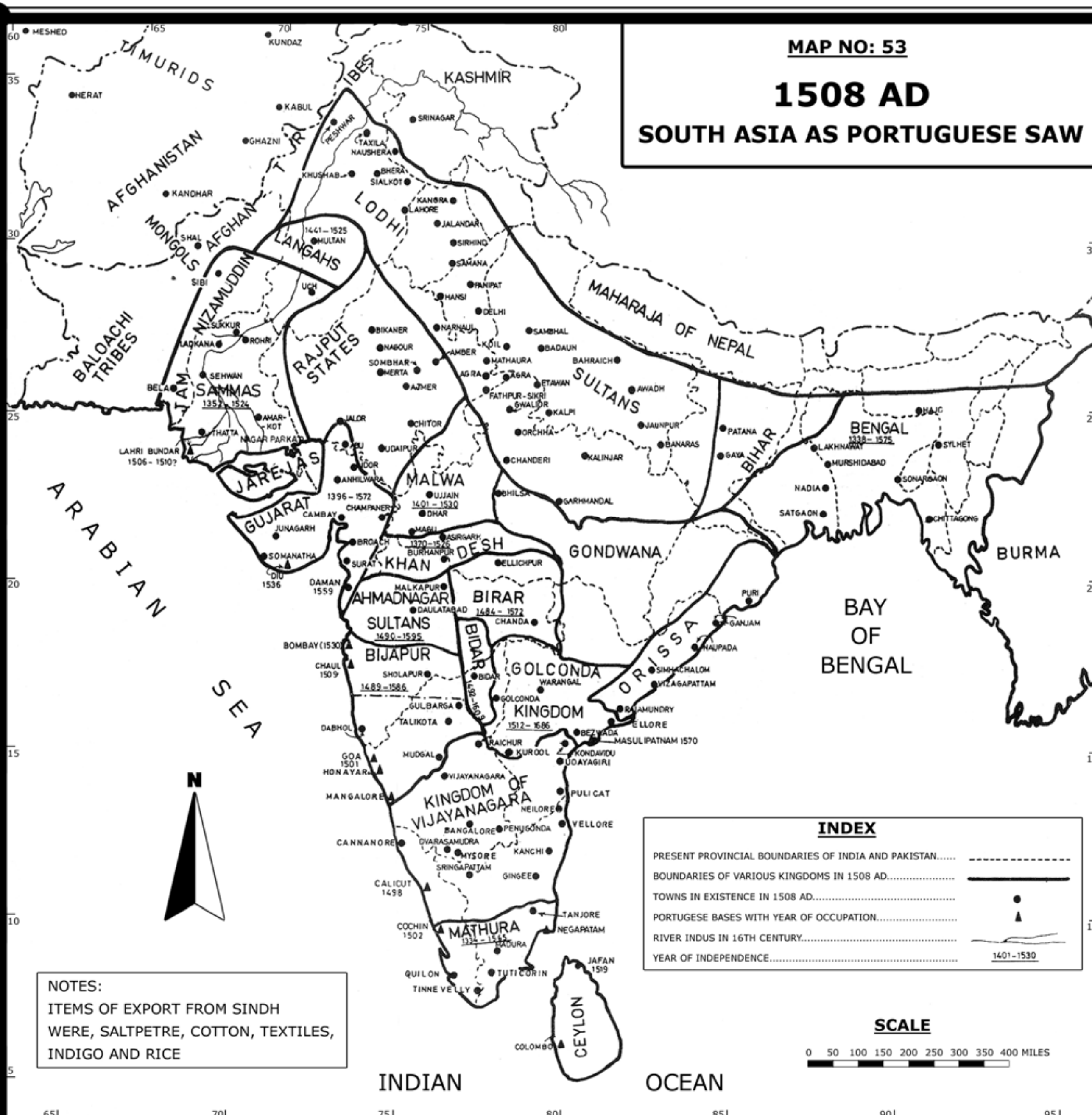


TUGHLAQS, THEIR COINS, POSTAL SERVICE, IBN-E-BATTUTTA AND CATAPULK

838. Muhammad Tughlaq (d. 1351 AD at Sonda). (Raza Library Rampur).
839. Feroz Shah Tughlaq (coroneted 1351 AD at Sonda). (Raza Library Rampur).
840. Brass coins of Muhammad Tughlaq (Forced Currency from Thomas).
841. Ibn Battutta.
842. Post runners as described by Ibn Battutta and used in Sindh by Bartle Frere. (Duarte, Sehwan).
843. Horseman for hire. Master piece statue at Florence.
844. 711-714 AD. A type of catapult or “Manjaneek”, which was used by Arabs during the siege of Debal. It was a Greek invention, developed and perfected by Romans, copied by Parthians and Sassanians of Iran and operated by army recruited by Muhammad bin Qasim from Iraq and Iran. Mehmud Ghaznavi used similar machines. South Asians did not use them on large scale. (MHP).



NOTE:-

THE RISE OF SMALL PRINCIPALITIES PRODUCED DEVELOPMENT OF REGIONAL CULTURES, LOCAL LANGUAGES AND LOCAL TRADESMEN IN ALL FIELDS INCLUDING ARCHITECTURE, WHICH INFLUENCE HAS CONTINUED TO THIS DAY. IT GAVE IMPETUS TO THE LOCAL ECONOMY AND AGRICULTURE. SINDH WAS VASSAL STATE BETWEEN 1388 AND 1385 AD.

THE SEQUENCE OF ESTABLISHMENT OF TRADE CENTRES AT VARIOUS PORTS WERE:
CALICUT 1498
COCHIN 1502
GOA 1509
JAFNA
IT COULD BE CONCLUDED THAT IN LAHRI BANDER, WHICH WAS EXPORTING PRODUCTS OF CENTRAL ASIA, AFGHANISTAN, PRESENT PAKISTAN AND EAST PUNJAB, THEY MAY HAVE ESTABLISHED THEIR FACTORY WITH OR WITHOUT PERMISSION BY 1510 - 1512 AD.

CHAPTER 26

THE LITTLE ICE AGE IN SINDH; 1530 - 1700 AD AND 1850 AD IN NORTHERN PARTS OF SOUTH ASIA

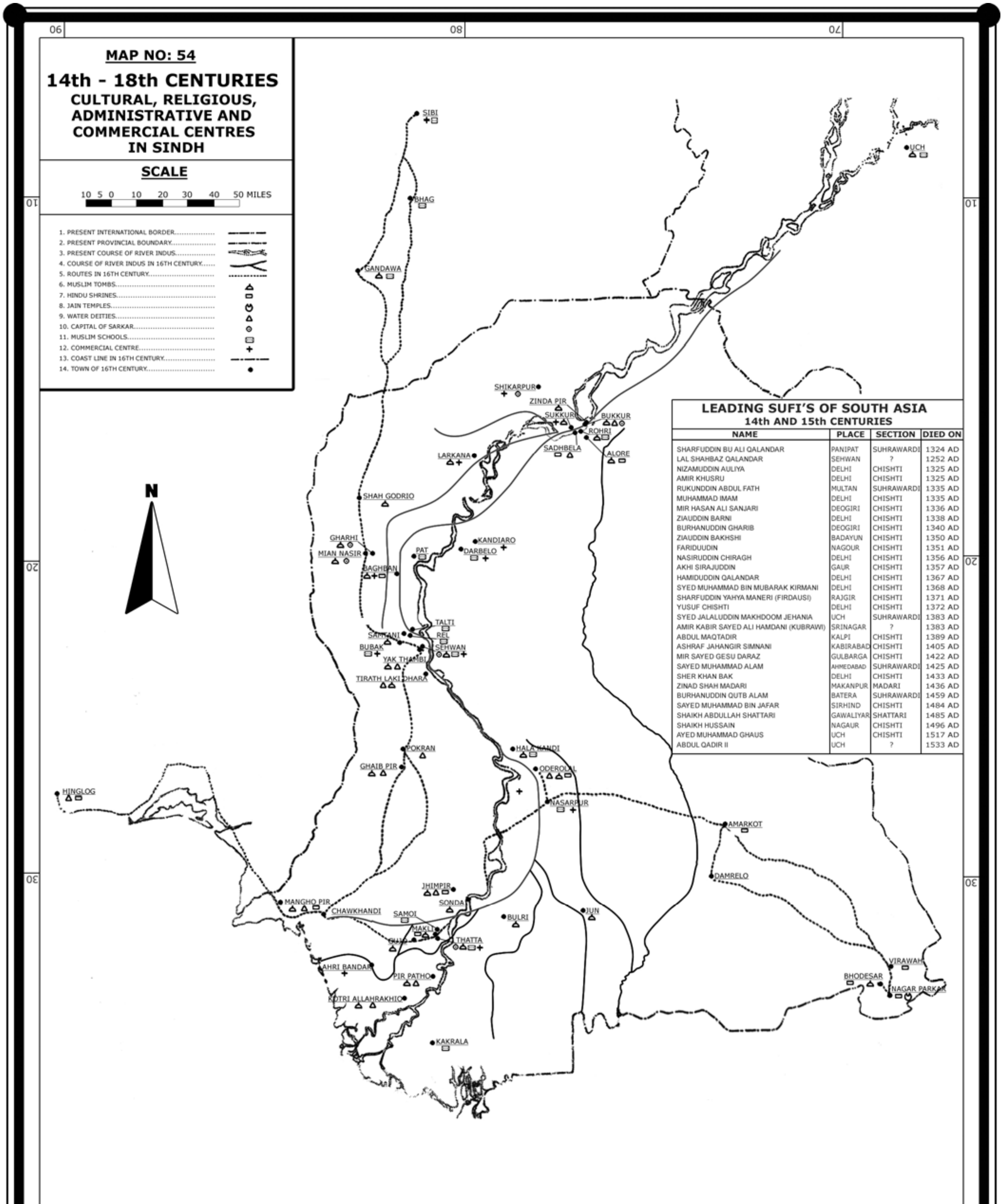
A recent scientific investigation (1850 AD) in northern parts of South Asia has shown that the global temperatures started dropping from 1430 AD. These were felt in the Central Asia around 1480 AD first, but the situation started worsening, there after 1500 AD leading to migration of Central Asian tribes to the South Asia from 1530-1660 AD. The process as applied to Sindh can be explained as under.

If temperature in the plains of the South Asia drops by 0.5^{o}C and in Himalayas by 1^{o}C effect on Sindh as compared to the normal year for example say 1930 AD shall be:

1. Snow, which normally melts in Himalayas by about 1st April, will melt about fifteen to thirty days late i.e., melting will start from 15th April to 1st May.
2. Melting of snow, which reaches its peak by about 15th June now, will be delayed up to end June. Because in normal years monsoon clouds reduce temperature and snow melts, but low temperatures will retard monsoon in Himalayas by about another fifteen days.
3. The inundation season will be delayed by about fifteen days and peak snow-melt flood (not monsoon) will reach Sindh by about end of July.
4. The level of water in the Indus will be lower than the normal by several feet. The monsoon will be late by fifteen days and would occur from 15th July to 15th August rather than 1st July.
5. The monsoon rains will bring flood water in the Indus and peak will reach Sindh from 1st August to 1st September.
6. Summer will start at least fifteen days late i.e. on 15th April rather than first April as it happens now.

The implication of this 0.5^{o}C temperature drop on inundation irrigated crops like rice, cotton and others will be as under:

- Canals will start flowing fifteen days late and reliable supplies of water for rice transplantation will be available from 15th July rather than 1st July as was happening in pre-barrage period.
- Level of water in the river will start falling from 1st September and the canals will not flow at all after 15th September.
- Rice transplanted on 15th July will grow but cannot mature due to lack of water in September and start of early winter in October. Only poor quality rice like Ratrhio, Ganjo, Kangni etc., which take sixty days to mature, can be raised and not the quality rice like Sugdasi, which takes 120 days.
- Inferior varieties of rice have low yield of fifty to sixty percent of quality rice, therefore total production will decrease.
- In order to ensure earlier maturity of late planted rice they will be broadcast rather than transplanted. This will further reduce yields to two third.
- The rice production will therefore be only forty to fifty percent of the normal.
- Sorghum, millet and short season crops will grow and mature. They will replace rice, but their yield per acre is much less than rice and production cannot support the population of Sindh.
- The long winter will help in increasing yield of wheat and other winter crops, but acreage under these crops will be limited due to non-availability of water in winter. Riverine areas will grow wheat and oil seeds but area will be limited.
- People will resort to pastoralism and put more animals in desert areas of Thar and Kohistan and extra pressure of animals on scanty resources



LEADING SUFI'S OF SOUTH ASIA
14th AND 15th CENTURIES

NAME	PLACE	SECTION	DIED ON
SHARFUDDIN BU ALI QALANDAR	PANIPAT	SUHRAWARDI	1324 AD
LAL SHAHBAZ QALANDAR	SEHWAN	?	1252 AD
NIZAMUDDIN AULIYA	DELHI	CHISHTI	1325 AD
AMIR KHUSRU	DELHI	CHISHTI	1325 AD
RUKUNDDIN ABDUL FATH	MULTAN	SUHRAWARDI	1335 AD
MUHAMMAD IMAM	DELHI	CHISHTI	1335 AD
MIR HASAN ALI SANJARI	DEOGIRI	CHISHTI	1336 AD
ZIAUDDIN BARNI	DELHI	CHISHTI	1338 AD
BURHANUDDIN GHARIB	DEOGIRI	CHISHTI	1340 AD
ZIAUDDIN BAKHSHI	BADAYUN	CHISHTI	1350 AD
FARIDUUDIN	NAGOUR	CHISHTI	1351 AD
NASIRUDDIN CHIRAGH	DELHI	CHISHTI	1356 AD
AKHI SIRAJUDDIN	GAUR	CHISHTI	1357 AD
HAMIDUDDIN QALANDAR	DELHI	CHISHTI	1367 AD
SYED MUHAMMAD BIN MUBARAK KIRMANI	DELHI	CHISHTI	1368 AD
SHARFUDDIN YAHYA MANERI (FIRDAUSI)	RAJGIR	CHISHTI	1371 AD
YUSUF CHISHTI	DELHI	CHISHTI	1372 AD
SYED JALALUDDIN MAKHDOOM JEHANIA	UCH	SUHRAWARDI	1383 AD
AMIR KABIR SAYED ALI HAMDANI (KUBRAWI)	SRINAGAR	?	1383 AD
ABDUL MAQTADIR	KALPI	CHISHTI	1389 AD
ASHRAF JAHANGIR SIMNANI	KABIRABAD	CHISHTI	1405 AD
MIR SAYED GESU DARAZ	GULBARGA	CHISHTI	1422 AD
SAYED MUHAMMAD ALAM	AHMEDABAD	SUHRAWARDI	1425 AD
SHER KHAN BAK	DELHI	CHISHTI	1433 AD
ZINAD SHAH MADARI	MAKANPUR	MADARI	1436 AD
BURHANUDDIN QUTB ALAM	BATERA	SUHRAWARDI	1459 AD
SAYED MUHAMMAD BIN JAFAR	SIRHIND	CHISHTI	1484 AD
SHAIKH ABDULLAH SHATTARI	GAWALIYAR	SHATTARI	1485 AD
SHAIKH HUSSAIN	NAGAUR	CHISHTI	1496 AD
AYED MUHAMMAD GHAUS	UCH	CHISHTI	1517 AD
ABDUL QADIR II	UCH	?	1533 AD

THIS WAS PERIOD OF SERIOUS DROUGHT FROM 1330 - 1400 IN MOST OF SOUTH ASIA; LESS RAINFALL DROUGHT, LESS PRODUCTION, POVERTY, HUNGER, STARVATION, DISEASES AND DEATH, AND TO CONSOLE PEOPLE ROSE MUSLIM SUFIS, HINDU BHAGATS AND, LATER ON, SIKH FOLLOWERS OF GURU NANIK, JUST AS DROUGHT IN THE 6TH CENTURY BC LEAD TO REFORMERS LIKE CONFUCIUS, ZOROASTER, BUDDHA AND MAHAVIRA.

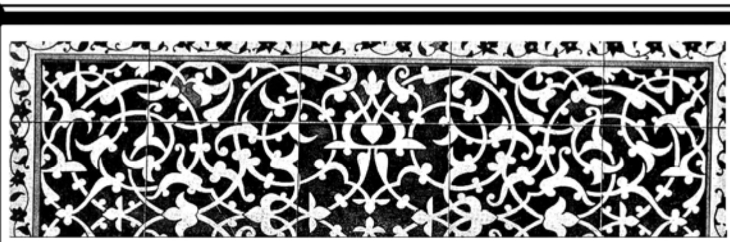
will create desertification and reduce capability of Thar and Kohistan to support extra animals.

- In general there will be food shortage and famine, which will increase death rate till population balances the food availability.
- Little Ice Age appeared in Sindh around its conquest by Arghoons in 1522 AD. The temperatures kept decreasing and so the agricultural production. Local rebellions started and they could not be crushed even up to the end of Arghoon-Tarkhan rule of Sindh in 1591 AD. They further continued under the Mughals.
- The historical impacts of the Little Ice Age in Sindh and South Asia can be known from the following examples:
- By about 1578 AD Sindh had worst famine lasting for some seven years. Mirza Baqi the Arghoon ruler hoarded grains, which he did not part with at any cost including assassination by his own men.
- The Little Ice Age also had hit the whole South Asia and even Fatehpur Sikri the new Mughal capital had to be abandoned in 1575 AD as the Jammuna River water could no longer be led to it.
- Amidst these troubles Akbar conquered and annexed Sindh, but due to Little Ice Age food production was less than the need of population and Sindh tribes continued rebellion.
- The little Ice Age reached its worst by 1665 AD when government revenue reduced to some one fifth of what it was sixty-five years ago in 1600 AD.
- In Sindh Little Ice Age receded by about 1700 AD, but this was short lived as the period 1760-1850 AD was again a cold period.
- In the northern Punjab it continued for another 100 years to 1800 AD leading to Sikh rebellions.
- Rebellions spread to the whole South Asia and it brought end of Mughal Empire in the early part of eighteenth century.
- Little Ice Age continued up to 1850 in Europe.
- The rise of Mughal Empire and its decline is associated with the Little Ice Age in the South Asia from 1522 to about 1700 or 1725 AD.

SOCIO-ECONOMIC IMPACT OF THE LITTLE ICE AGE

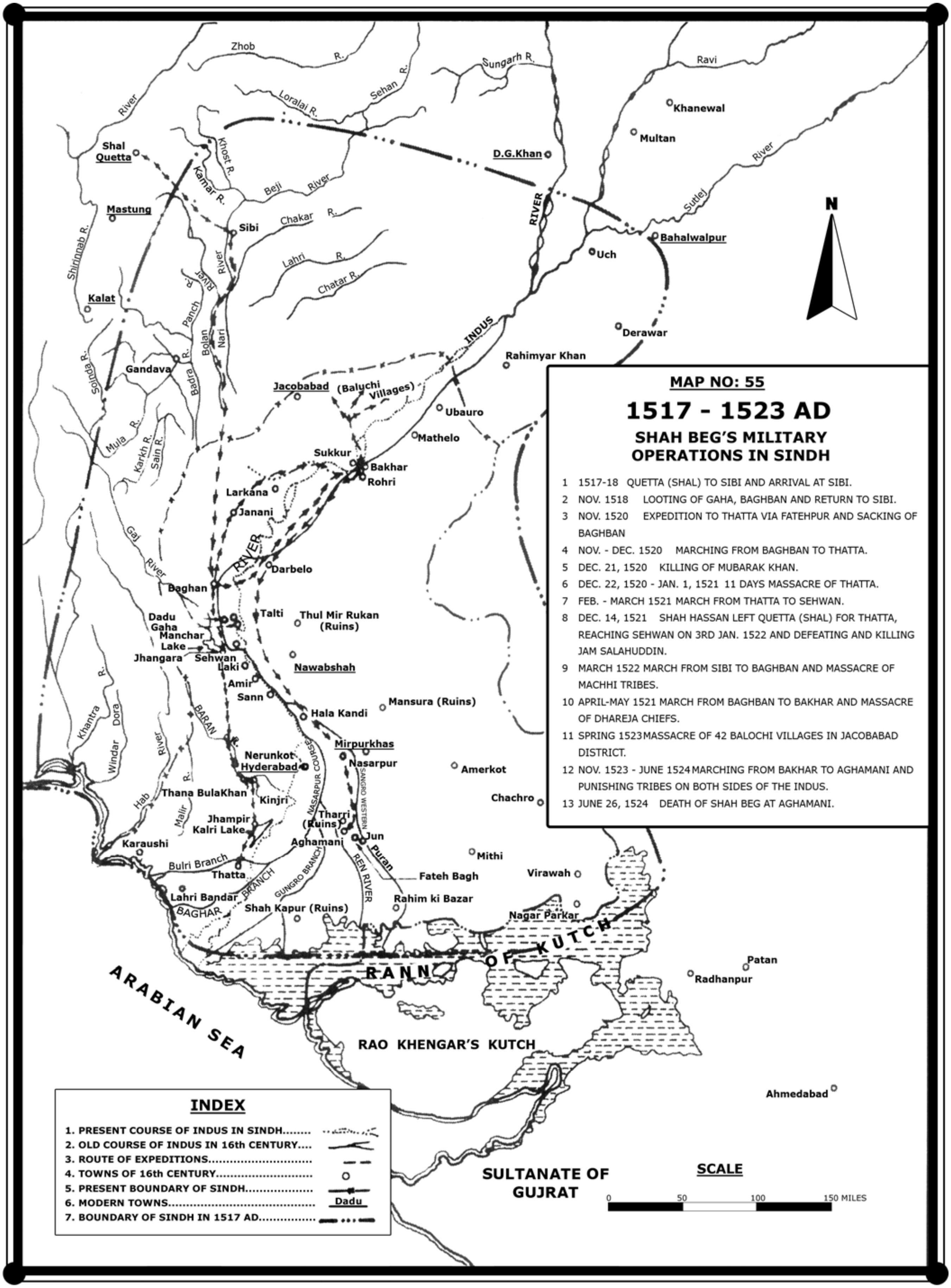
Consequences of Little Ice Age were: reduction in production, famine, starvation and death and this led to uprisings against Arghoons, Tarkhans and Mughals from 1522-1700 AD. The chaotic conditions forced migration of people from Sindh to Kutch, Kathiawar, Gujarat and Burhanpur. Many Sindhis also migrated to Jeddah, Mecca and Medina where their decedents still call themselves Al-Sindhi. The people living in Sindh resorted to nomadic life and pastoral animal husbandry. Only the canals in the low lying areas were flowing. Such areas were present Jacobabad, Shikarpur, Larkana and northern Dadu districts. Hardly any canals were working on the left bank of the river and the whole area under the present Naushehro Feroz, Nawabshah, Sanghar and Hyderabad districts was under rebellions led by the different Samma clans or tribes. The taxes were recovered only at the point of sword. Most of the canals were not cleared and had choked up badly. In general, production had reduced to the half of 1522 AD level and so the population. At least half the population was in rebellion and during famine conditions at least on some occasions people resorted to cannibalism.

To console people Sufis, Bhagats and religious reformers rose during the era. From 1500-1700 AD Six Gowswamins systematised Vaisnava theology, Kabir Das (1500-1600 AD) started Sakhis and Nirguna Bhagti movement. During the period Mirabai the Vaisnava poetess, Sankara Deva another Vaisnava poet of Asama, Surdasa the great blind poet of Kirshra Bhagti School and Tukaram of Maharashtra also taught meditation. The other reformers of the period were: Shrinivas, Krishnadas etc.



845. Jami Masjid Thatta, glazed tile, 1643 AD.

846. Mosque Shah Jehan Thatta, glazed tile.



MAP NO: 55
1517 - 1523 AD
SHAH BEG'S MILITARY OPERATIONS IN SINDH
1 1517-18 QUETTA (SHAL) TO SIBI AND ARRIVAL AT SIBI.
2 NOV. 1518 LOOTING OF GAHA, BAGHBAN AND RETURN TO SIBI.
3 NOV. 1520 EXPEDITION TO THATTA VIA FATEHPUR AND SACKING OF BAGHBAN
4 NOV. - DEC. 1520 MARCHING FROM BAGHBAN TO THATTA.
5 DEC. 21, 1520 KILLING OF MUBARAK KHAN.
6 DEC. 22, 1520 - JAN. 1, 1521 11 DAYS MASSACRE OF THATTA.
7 FEB. - MARCH 1521 MARCH FROM THATTA TO SEHWAN.
8 DEC. 14, 1521 SHAH HASSAN LEFT QUETTA (SHAL) FOR THATTA, REACHING SEHWAN ON 3RD JAN. 1522 AND DEFEATING AND KILLING JAM SALAHUDDIN.
9 MARCH 1522 MARCH FROM SIBI TO BAGHBAN AND MASSACRE OF MACHHI TRIBES.
10 APRIL-MAY 1521 MARCH FROM BAGHBAN TO BAKHAR AND MASSACRE OF DHAREJA CHIEFS.
11 SPRING 1523 MASSACRE OF 42 BALOCHI VILLAGES IN JACOBABAD DISTRICT.
12 NOV. 1523 - JUNE 1524 MARCHING FROM BAKHAR TO AGHAMANI AND PUNISHING TRIBES ON BOTH SIDES OF THE INDUS.
13 JUNE 26, 1524 DEATH OF SHAH BEG AT AGHAMANI.
INDEX
1. PRESENT COURSE OF INDUS IN SINDH........
2. OLD COURSE OF INDUS IN 16th CENTURY....
3. ROUTE OF EXPEDITIONS............................
4. TOWNS OF 16th CENTURY...........................
5. PRESENT BOUNDARY OF SINDH..................
6. MODERN TOWNS..
Dadu
7. BOUNDARY OF SINDH IN 1517 AD...............
SCALE
0 50 100 150 MILES
N
Zhob R.
River
Loralai R.
Sehan R.
Sungarh R.
Ravi
Khanewal
Multan
D.G.Khan
Shal
Quetta
Khost R.
Kamar R.
Beji River
Mastung
Sibi
Chakar R.
Shirinnab R.
River
RIVER
Sutlej
River
Bahalwalpur
Uch
Lahri R.
Chatar R.
Kalat
Panch R.
River
Bolan
Nari
Derawar
INDUS
Rahimyar Khan
Gandava
Solnda R.
Badra
Jacobabad
(Baluchi Villages)
Ubauro
Mula R.
Karkh R.
Sain R.
Mathelo
Sukkur
Bakhar
Rohri
Larkana
Janani
Gaj River
RIVER
Darbelo
Baghan
Talti
Thul Mir Rukan (Ruins)
Dadu
Gaha
Manchar Lake
Jhangara
Sehwan
Laki
Nawabshah
Amir
Sann
Mansura (Ruins)
Hala Kandi
Khantra
Dora
BARAN
Mirpurkhas
Nerunkot
Hyderabad
Nasarpur
Amerkot
Windar
River
R.
Thana BulaKhan
Kinjri
NASARPUR COURSE
SANGRO WESTERN
Chachro
Hab
Malir
Jhampir
Kalri Lake
Tharri (Ruins)
Jun
Karaushi
Aghamani
Puran
Mithi
Bulri Branch
Thatta
BRANCH
GUNGRO BRANCH
REN RIVER
Fateh Bagh
Virawah
Lahri Bandar
BAGHAR
Shah Kapur (Ruins)
Rahim ki Bazar
Nagar Parkar
RANN OF KUTCH
Patan
Radhanpur
ARABIAN SEA
RAO KHENGAR'S KUTCH
Ahmedabad
SULTANATE OF GUJRAT

CHAPTER 27

IRRIGATION UNDER ARGHOONS, TARKHANS AND MUGHAL GOVERNORS OF SINDH; 1522 - 1701 AD

Little Ice Age described in the last chapter shows the conditions, which forced Arghoons and Tarkhans to conquer Sindh and bring mass migration of those tribes from the Central Asia to Sindh. In article titled "Heroic struggle of Sindh against feudalism" the present writer has analysed the circumstances under which chaotic conditions were created in Sindh and economy destroyed during this period. To reflect these circumstances the chronology of a few important incidents, which took place, is described in following paragraphs:

Arghoons with the help of Tarkhans conquered Sindh from Sammas in 1522 AD. They were under pressure from Babur to vacate Kandhar and had to find a new abode. They also were forced to settle their tribes in Sindh by displacement of locals from urban areas.

They carried out massacre in Thatta for 20 days. From there and other towns also local population was removed to create place for Arghoon and Tarkhan tribes. According to a contemporary historian; “Those who were cavalrymen with sword in their hand had plough yoke in hand and were driving oxen in the fields eaten”. But the strategy worked as far as Shah Hasan was concerned. Humayun’s troops killed camp animals and ate them. Very large proportion of his two-hundred-thousand troops deserted the camp and roamed in Sindh in search of food and shelter. Humayun had at times to ask his adversaries – the local governors and agents in Sindh – to supply him grain. This request was invariably granted so as not to drive him to desperation to wage a war. Due to famine conditions epidemics prevailed, causing heavy mortality among the royal followers. Some deserters joined Shah Hasan. Finally, having lost his men, treasure and confidence of the followers Humayun made peace on conditions of safe passage through Sindh and provisions en-route.

Feuds started on Shah Hasan’s death in 1555 AD. Sultan Mahmud ruler of Bakhar wanted to capture Sehwan Sarkar and Mirza Isa Tarkhan ruler of Thatta wanted to do the same. Tarkhans called the Portuguese to help them in a feud with Arghoons under certain terms. These were not fulfilled providing pretence for the Portuguese to loot, burn and destroy Thatta the prosperous capital of Sindh in 1555 AD.

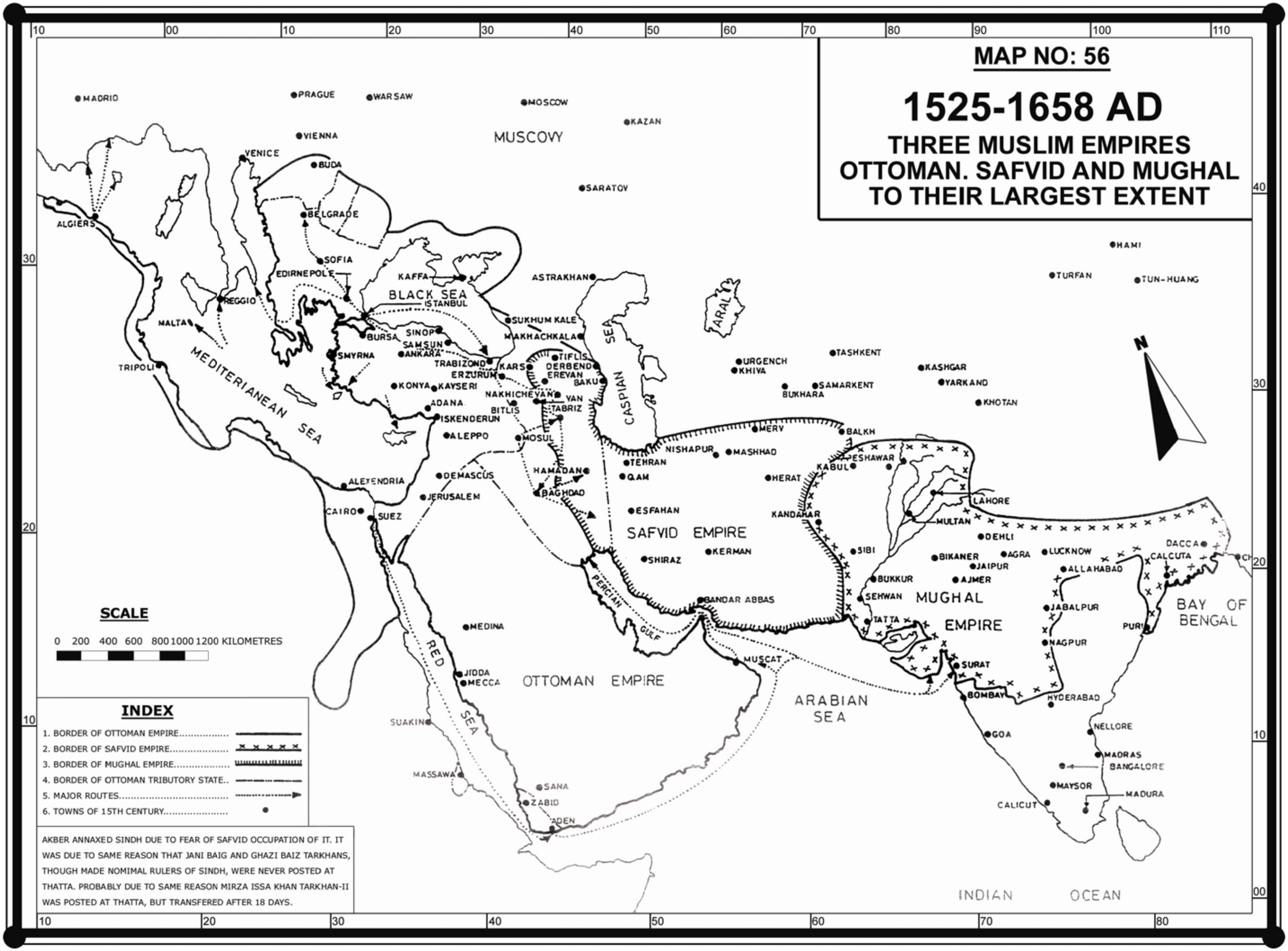
Due to these conditions large number of businessmen, artisans, scholars and Sufis migrated to Kutch, Kathiawar, Gujarat, Hyderabad Deccan and Arabia.

Famine in Sindh was caused by the “Little Ice Age”, which had hit Sindh in 1530 AD. Famine had reached the worst by about 1575-85 AD. Akbar introduced Mansabdari system. Mansabdar was a military governor who collected land revenue and irrigation water charges. He was also to impart justice, police to maintain law and order, de-silt canals and re-distribute land. He in fact was a local despot with un-limited powers and responsible only to the Emperor.

Sultan Mahmud of Bakhar had no male issue and had sent his daughter to the harem of Akbar Badshah of Delhi leaving instructions that Bakhar Sarkar will go to Akbar on his death, which occurred in 1587 and soon Akbar decided to conquer Sindh in 1591 AD. Sindh was divided in 3 Sarkars; Bakhar, Sehwan and Thatta and governors were sent there. The governors were independent of each other.

MUGHAL GOVERNORS OF BAKHAR (1575-1679 AD)

Bakhar saw 50 governors in 104 years. Tenure change was so frequent that their average tenure was about 2 years during which they had to run administration, which was mostly despotic, maintain army and pay a fixed sum to the central treasury. Burden of taxes was on agriculture, which depended on irrigation from canals and these required silt clearance every year for which governor had to advance money. Governors not being sure of their


MAP NO: 56
1525-1658 AD
THREE MUSLIM EMPIRES
OTTOMAN. SAFVID AND MUGHAL
TO THEIR LARGEST EXTENT
MUSCOVY
MADRID
PRAGUE
WARSAW
MOSCOW
KAZAN
VIENNA
VENICE
BUDA
SARATOV
ALGIERS
BELGRADE
SOFIA
EDIRNEPOLE
KAFFA
BLACK SEA
ISTANBUL
ASTRAKHAN
REGGIO
MALTA
TRIPOLI
MEDITERIANEAN SEA
BURSA
SINOP
SAMSUN
ANKARA
SMYRNA
TRABIZOND
ERZURUM
KARS
SUKHUM KALE
MAKHACHKALA
TIFLIS
DERBEND
EREVAN
BAKU
CASPIAN SEA
ARAL
KONYA
KAYSERI
NAKHICHEVAN
VAN
BITLIS
TABRIZ
ADANA
ISKENDERUN
ALEPPO
MOSUL
HAMADAN
BAGHDAD
ALEXENDRIA
DEMASCUS
JERUSALEM
CAIRO
SUEZ
TASHKENT
URGENCH
KHIVA
BUKHARA
SAMARKENT
KASHGAR
YARKAND
KHOTAN
MERV
NISHAPUR
MASHHAD
TEHRAN
QAM
ESFAHAN
HERAT
BALKH
KABUL
PESHAWAR
KANDAHAR
SAFVID EMPIRE
SHIRAZ
KERMAN
BANDAR ABBAS
PERCIAN GULF
HAMI
TURFAN
TUN-HUANG
N
LAHORE
MULTAN
DEHLI
BIKANER
AGRA
LUCKNOW
JAIPUR
AJMER
ALLAHABAD
DACCA
CALCUTA
SIBI
BUKKUR
SEHWAN
TATTA
MUGHAL EMPIRE
JABALPUR
NAGPUR
SURAT
BOMBAY
HYDERABAD
PURI
BAY OF BENGAL
MEDINA
JIDDA
MECCA
OTTOMAN EMPIRE
RED SEA
MUSCAT
ARABIAN SEA
SUAKIN
MASSAWA
SANA
ZABID
ADEN
GOA
NELLORE
MADRAS
BANGALORE
MAYSOR
MADURA
CALICUT
INDIAN OCEAN
SCALE
0 200 400 600 800 1000 1200 KILOMETRES
INDEX
1. BORDER OF OTTOMAN EMPIRE
2. BORDER OF SAFVID EMPIRE
3. BORDER OF MUGHAL EMPIRE
4. BORDER OF OTTOMAN TRIBUTORY STATE
5. MAJOR ROUTES
6. TOWNS OF 15TH CENTURY
AKBER ANNAXED SINDH DUE TO FEAR OF SAFVID OCCUPATION OF IT. IT WAS DUE TO SAME REASON THAT JANI BAIG AND GHAZI BAIZ TARKHANS, THOUGH MADE NOMIMAL RULERS OF SINDH, WERE NEVER POSTED AT THATTA. PROBABLY DUE TO SAME REASON MIRZA ISSA KHAN TARKHAN-II WAS POSTED AT THATTA, BUT TRANSFERED AFTER 18 DAYS.

tenure even for a year did not spare these funds and this reduced cultivated area and returns. Besides it created famine conditions among the cultivators.

No governor was deputed to Bakhar after 1679 AD. Various scattered records show that the whole Sarkar was occupied by local tribes namely: Daudpottas – Jacobabad and Shikarpur districts; Kalhoras – Sukkur taluka and Larkana district and Panhwars – Dadu district soon after 1660 AD. Some Samma tribes had also occupied Bakhar Sarkar areas on the left bank of the River Indus in the present Ghotki district and Rohri taluka.

MUGHAL GOVERNORS OF SEHWAN

Even before Bakhar most of Sehwan Sarkar was also lost to local tribes, but all these tribes with exception of Kalhoras were acting officially on behalf of Mughals and were paying some tribute.

MUGHAL GOVERNORS OF THATTA

Between 1591-1738 AD Mughal or Tarkhan governors of Sindh numbered to 60 with average tenure of less than 2 ½ years. This short tenure and uncertainty led to similar problems for the government as in Bakhar and Sehwan.

The main defect of Mughal administration of the provinces was that after defeat of Humayun at hands of Sher Shah they did not trust local Muslims and appointed Mughals as Mansabdar etc. To pass for Mughal assignment he had to be fair in colour (like Iranian and Central Asian), born outside South Asia and not married to a local Muslim woman. The knowledge of local languages was not considered necessary. The consequence was that local Muslims tried to show that they were immigrants from some Muslim country. The new comers married local women of fair colour so that their children pass for Mughals' posts and it encouraged continuous migration from Iran and Central Asia. Further to this Akbar’s decision that on death of a Mansabdar his movable and immovable property, inclusive of his harem, would be confiscated to the state simply caused extravagance among Mansabdars who then built no palaces but glorious tombs in their life time for their eternal rest.

All these factors caused abandoning of land by cultivators. Those who cultivated it had to pay much higher taxes to meet demand of the Mansabdar for his upkeep and to send a certain amount to the central treasury he was bound to.

Consequence of this type of maladministration resulted in chaotic conditions discussed in paragraphs that follow.

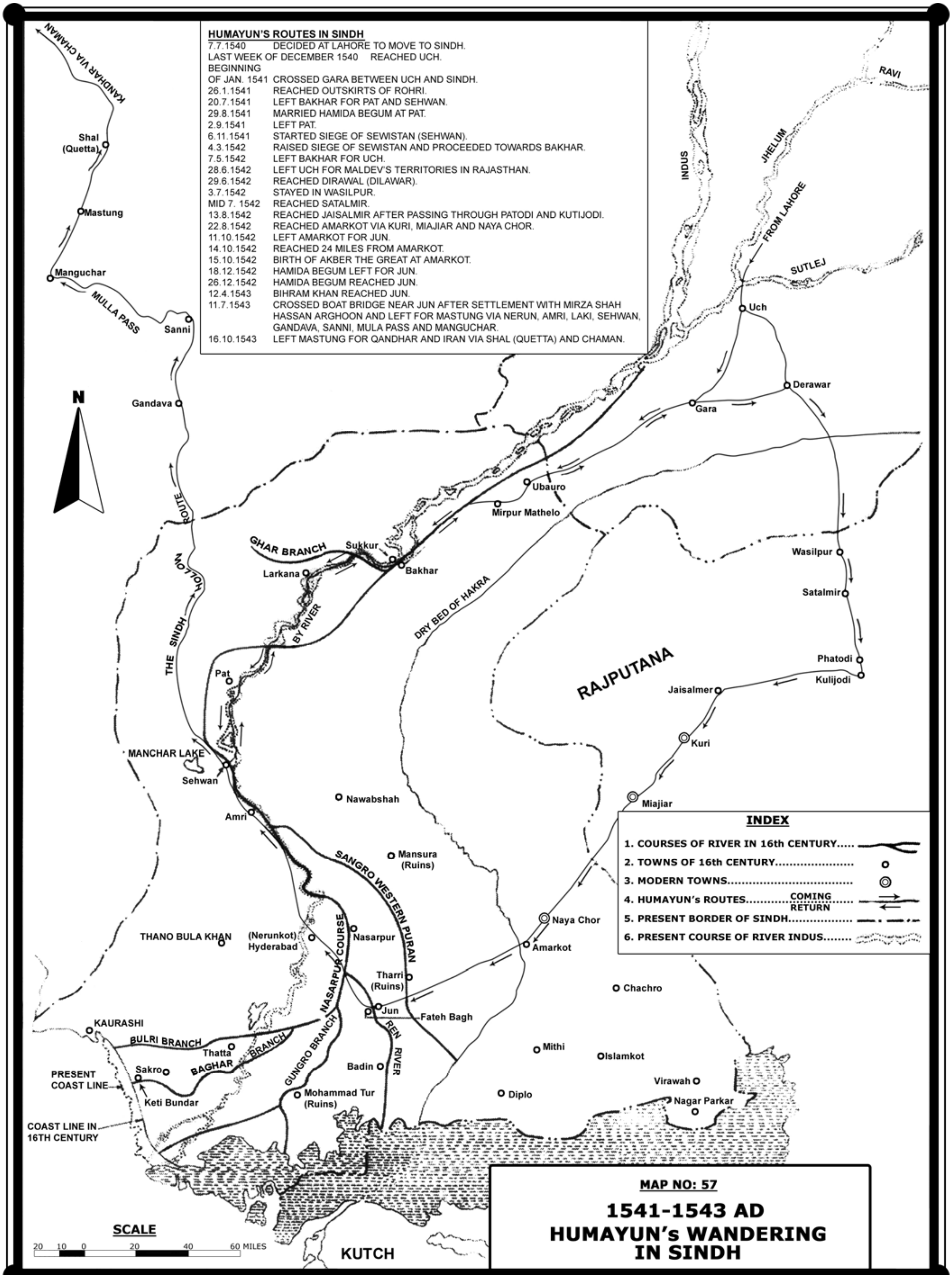
The local tribes belonging to Samma clans and Balochis organised resistance and the civil war with Arghoons and Tarkhans continued until the conquest of Sindh by Akbar. In the meantime irrigation system started decaying. In 1634 AD Yousif Mirak addressed an eight-hundred pages letter to Shah Jehan in which he gave details of bad administration of Mughal governors, negligence of canal system and rebellion of Sammas and other tribes. The rebellion amounting to civil war started from early Arghoon period and continued through to Shah Jehan’s days and is reported by Beglar Namah, Tarkhan Namah, Tahiri and the records of East India Company (ed. Foster), which had factory at Thatta between 1635-1662 AD. Reports of the European travellers namely; Worthington, Manrique, Manucci and Hamilton and some of the letters from Aurangzeb while he was governor of Multan to his father (in Ruq’at-i-Alamgir and Muk'at-i-Alamgir) confirm this.

Under such chaotic conditions irrigational system in Sindh went into ruin. According Mirak many of governors, Mansabdars and allottees of lands by the crown were unfamiliar with irrigated agriculture and the canals remained un-cleared. Tribes in rebellion turned outlaw and robbed those who cultivated lands. From the detailed accounts it appears that:

- At least half of population was in rebellion. They resorted to animal husbandry on pastures, refusing to pay dues and attacked those who cultivated lands and paid taxes.
- Taxes were recovered only at the point of sword.
- Most of the canals were not cleared so they choked-up.
- Many fertile areas turned into desert.
- Due to decrease in irrigated area the food production decreased and so did the population.

There were famine conditions to such severity that at least on some occasions people resorted to cannibalism. By 1662 AD area under irrigation as well as population of Sindh must have reduced to less than half of that in 1522 AD. The income from Thatta Sarkar to the central treasury was twenty percent in 1665 as compared to 1600 AD as per figures of Ain-i-Akbari and Bernier.

There are no records available after 1662 AD, but chaotic conditions increased so much that Mughal


HUMAYUN'S ROUTES IN SINDH
7.7.1540 DECIDED AT LAHORE TO MOVE TO SINDH.
LAST WEEK OF DECEMBER 1540 REACHED UCH.
BEGINNING OF JAN. 1541 CROSSED GARA BETWEEN UCH AND SINDH.
26.1.1541 REACHED OUTSKIRTS OF ROHRI.
20.7.1541 LEFT BAKHAR FOR PAT AND SEHWAN.
29.8.1541 MARRIED HAMIDA BEGUM AT PAT.
2.9.1541 LEFT PAT.
6.11.1541 STARTED SIEGE OF SEWISTAN (SEHWAN).
4.3.1542 RAISED SIEGE OF SEWISTAN AND PROCEEDED TOWARDS BAKHAR.
7.5.1542 LEFT BAKHAR FOR UCH.
28.6.1542 LEFT UCH FOR MALDEV'S TERRITORIES IN RAJASTHAN.
29.6.1542 REACHED DIRAWAL (DILAWAR).
3.7.1542 STAYED IN WASILPUR.
MID 7. 1542 REACHED SATALMIR.
13.8.1542 REACHED JAISALMIR AFTER PASSING THROUGH PATODI AND KUTIJODI.
22.8.1542 REACHED AMARKOT VIA KURI, MIAJIAR AND NAYA CHOR.
11.10.1542 LEFT AMARKOT FOR JUN.
14.10.1542 REACHED 24 MILES FROM AMARKOT.
15.10.1542 BIRTH OF AKBER THE GREAT AT AMARKOT.
18.12.1542 HAMIDA BEGUM LEFT FOR JUN.
26.12.1542 HAMIDA BEGUM REACHED JUN.
12.4.1543 BIHRAM KHAN REACHED JUN.
11.7.1543 CROSSED BOAT BRIDGE NEAR JUN AFTER SETTLEMENT WITH MIRZA SHAH HASSAN ARGHOON AND LEFT FOR MASTUNG VIA NERUN, AMRI, LAKI, SEHWAN, GANDAVA, SANNI, MULA PASS AND MANGUCHAR.
16.10.1543 LEFT MASTUNG FOR QANDHAR AND IRAN VIA SHAL (QUETTA) AND CHAMAN.
KANDHAR VIA CHAMAN
Shal (Quetta)
Mastung
Manguchar
MULLA PASS
Sanni
Gandava
N
THE SINDH HOLLOW ROUTE
GHAR BRANCH
Sukkur
Larkana
Bakhar
BY RIVER
Pat
MANCHAR LAKE
Sehwan
Amri
Nawabshah
Mansura (Ruins)
SANGRO WESTERN PURAN
NASARPUR COURSE
Nasarpur
(Nerunkot) Hyderabad
THANO BULA KHAN
Tharri (Ruins)
Jun
Fateh Bagh
REN RIVER
KAURASHI
BULRI BRANCH
BAGHAR BRANCH
Thatta
Sakro
PRESENT COAST LINE
Keti Bundar
GUNGRO BRANCH
Badin
Mohammad Tur (Ruins)
COAST LINE IN 16TH CENTURY
SCALE
20 10 0 20 40 60 MILES
KUTCH
INDUS
JHELUM
RAVI
FROM LAHORE
SUTLEJ
Uch
Derawar
Gara
Ubauro
Mirpur Mathelo
DRY BED OF HAKRA
Wasilpur
Satalmir
Phatodi
Kulijodi
RAJPUTANA
Jaisalmer
Kuri
Miajiar
Naya Chor
Amarkot
Chachro
Mithi
Islamkot
Diplo
Virawah
Nagar Parkar
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2. TOWNS OF 16th CENTURY.....................
3. MODERN TOWNS...................................
4. HUMAYUN's ROUTES............ COMING RETURN
5. PRESENT BORDER OF SINDH.................
6. PRESENT COURSE OF RIVER INDUS........
MAP NO: 57
1541-1543 AD
HUMAYUN's WANDERING IN SINDH

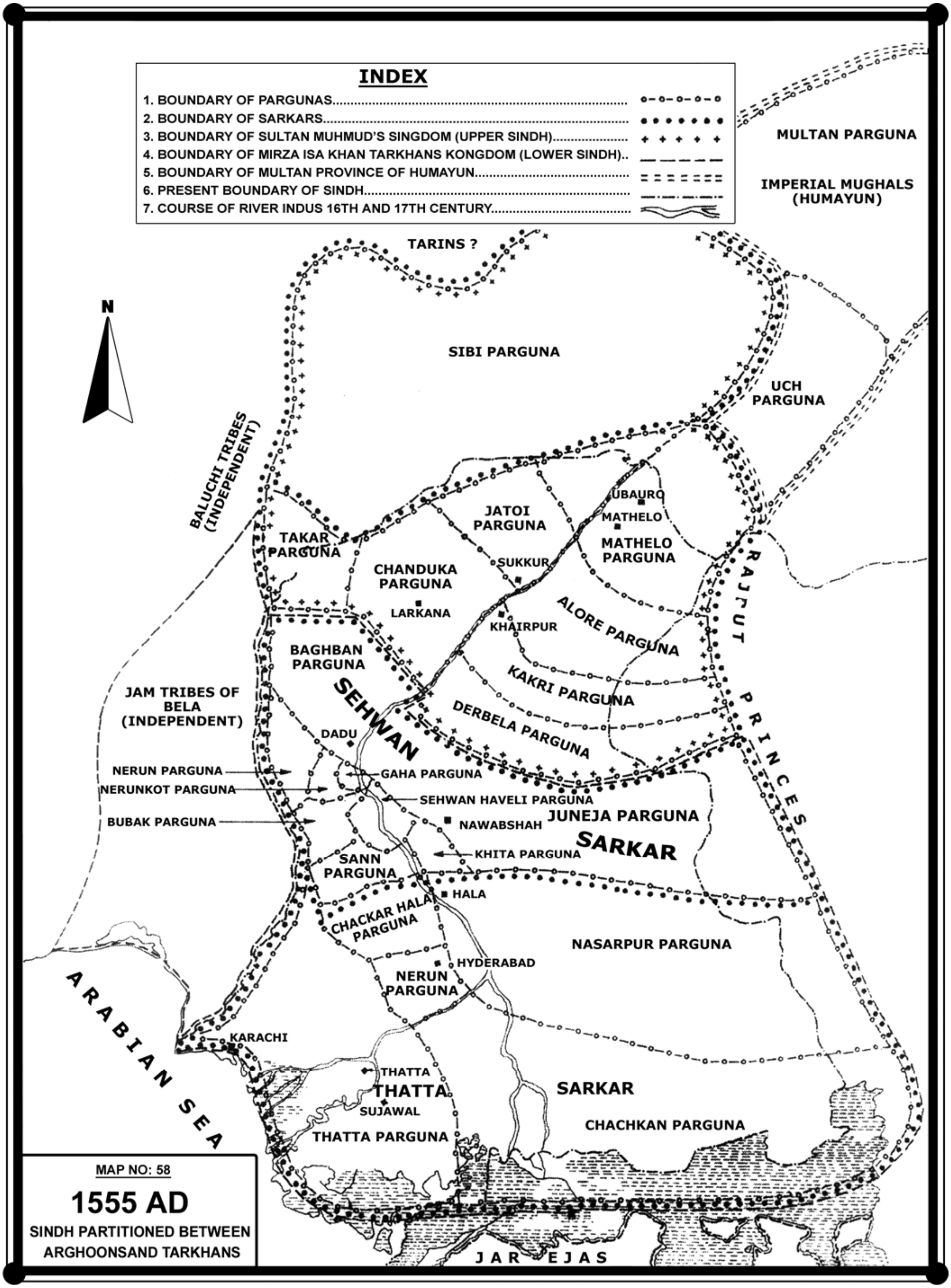
governor at Multan (who later on became emperor Bahadur Shah-I) accepted a local tribal head (Panhwar by caste) to act as hereditary official governor for the present northern Dadu and southern Larkana districts. This arrangement lasted for many years as they had time to build religious and secular structures and capital town named Shikarpur. They were finally removed without much struggle by Kalhoras who had turned so powerful that they defeated imperial army in Dadu district and the Multan governor was compelled to accept them as official hereditary governors in the place of Panhwars. Panhwar tribe seems to have been settled by Soomras or Sammas on a small branch, which the River Indus established from Radhan to Talti in the late Soomra or early Samma period. This branch dried up in the sixteenth century, but they were re-settled on both banks of southern part of Western Nara i.e., Dadu, Johi and Sehwan talukas by the Sammas. Having been accepted as local governors or Subedars in the later part of seventeenth century they occupied lands in Kambar and Khairpur Nathan Shah talukas too. Kambar and Warah talukas had a canal operating up to 1931 called Panhwarki. They also built a township at Garhi in Khairpur Nathan Shah taluka. Kalhoras took away their possessions in these two talukas.

During the Little Ice Age water flows and level of water in the Indus dropped considerably and canals did not flow full. The area under Rizani (flooded by the Indus) though decreased, but it gained importance as source better than others for food production. In the same way Kaja area (flooded by rainwater) in Kachho and Kohistan became another food and fodder producing area. The Arghoons, Tarkhans and Mughals being unfamiliar with functioning of canals, peculiar behavior of the Indus and silting of mouths of canals simply neglected irrigation. No new canals were constructed during the period. Mirak reports that a breach in the Nala Sawah in Johi taluka built in Jam Nizamuddin’s reign on Gaj and other Nais a century-and-half earlier remained without repairs even though it was not far from Sehwan the headquarters of the governor of the central Sindh. Hurlos or low lift water wheels were employed on canals flowing below the level of lands to be irrigated. Even lined or unlined deep wells fifteen to thirty feet deep were pumped for irrigation by use of Nar (a deep well water lift). It was called Chhuhi system of irrigation.

Crops raised were the same as during Samma period. For example; rice in north-western Sindh up to vicinity of Sehwan and in Kotri Barrage areas; dry crop like millet, sorghum, cotton and sugarcane in lift areas and wheat, barely, oil seeds, peas and beans in riverine areas. The barani areas of Kachho grew sorghum and Thar only millet. Riverine areas produced wheat, barley and oil seeds in winter and occasionally sorghum and millet in summer. Maize was late comer from Americas brought by the Portuguese. The Portuguese also brought tobacco, papaya, guava, pineapple, cashew and sweet potato from South America, pea nut from Africa, red chilies or pepper from Pernambuco and lychee and sweet orange from China to South Asia. The dates of their introduction in Sindh are not known, but tobacco, maize and red pepper must have been introduced quite early. Highly decorative tobacco Hubble-bubble smoking devices have been unearthed from Khudabad district Dadu belonging to period 1665-1700 AD. Sweet oranges were already known in South Asia, but they may have added new cultivars. The Sindh enjoyed natural aquatic plant fruits and roots called Bih, Kumm, Lorh, Nap and louts nuts. Buri was taken from roots of Der a reed.

Cotton, which grew in abundance in Sindh under Soomras and Sammas, declined due to neglect of canals, but yet it was an important crop. Cotton grew in Gujarat and came to Sindh via Kutch to feed two thousand looms in Thatta as Manrique observed. There were two types of cotton varieties Nairi (annual) and Nuradi (perennial trees). The perennial trees were very tall and full of small snakes as reported by Masumi. Trees had to be shaken off the snakes before harvesting cotton. Melons of various types and cucurbitae were grown on preserved moisture in rain-fed and riverine areas. Textiles centres were; Thatta, Nasarpur, Sehwan, Darbelo, Kandiaro, Gambat, Sukkur and Bakhar. Due to Little Ice Age aridity a large number of people in textile business from spinning to weaving, printing and marketing calling themselves Memons and Khatris moved to Kutch, Kathiawar, Gujarat, Burhanpur and other places in search of cotton and its products. Their Pirs followed them.

Indigo was the fifth largest industrial crop after cotton, tobacco, sugarcane and opium. The Portuguese took indigo to West Indies. By 1650 AD that country became chief exporter of it to England and cultivation of indigo got set back in Sindh. The central Sindh – Sehwan Sarkar – was the centre of indigo production. Its production came to an end when around 1930 AD BASF synthesised and produced it commercially at cheaper rates. Opium



MAP NO: 58

1555 AD

SINDH PARTITIONED BETWEEN ARGHOONSAND TARKHANS

was largely cultivated for marijuana smoking, drinks from its seeds by crushing or boiling and for extraction of opium. Sugarcane was grown from time immemorial. Sindh grew natural rope making material in wild along irrigation channels. Of these common were Munja (saccharum munja) or balbaja (eleusion indica) and many others. Animal husbandry has preceded agriculture. Agriculture provided fodder, grains and oil as animal feed and their milk was converted into clarified butter and oil. Butter had impurities and therefore there was deduction of 1/32nd weight when sold to any buyer in the whole chain of sales. Animal bones, hides and wool formed important items of trade and were made blankets (Kambals) and Khatha (rough sheets) for wrapping around the body as protection against cold. Agriculture on rain fall in Sindh has very little share in the economy. On it sorghum was raised in Kohistan and millet in Thar. Some times 'Til' (sesame), a popular oil seed was also grown. Population of Sindh must have reached a low ebb of about one million by the time of Mirak (1634 AD) and must have remained stagnant over next forty years. In the last quarter of that century local tribes became powerful and managed canals themselves. Population must have gone up by fifty percent in these years reaching 1.5 millions by 1700 AD.

Sixteenth century was the zenith of the Portuguese trade in the South Asia. From the beginning of seventeenth century the Portuguese trade and power declined and new European powers – the Dutch, the English and the French developed trade as well as local influence in Mughal courts. The Portuguese maintained good relations with the local officials of Sindh even after Akbar's conquest of it in 1591 AD. During the two centuries 1500-1700 AD imports into Sindh were: metals, particularly silver. No outgoing sea vessels were owned by locals. It was a European monopoly. Sindh's export trade mainly was textiles. Silver and gold had always been major items of import in the South Asia probably dating back to Harappan time. The farming community converted their income into precious metals, which their women-folk wore all the time. It was also used for immediate mortgage or encashment in the hour of need. It was only the second half of the last century that silver was allowed to be exported and silver as metal for ornaments has lost its unique position. Since it is an industrial metal government probably under pressure or ill advice allowed it to be exported after 1950 AD and its price has shot up one hundred times since then.

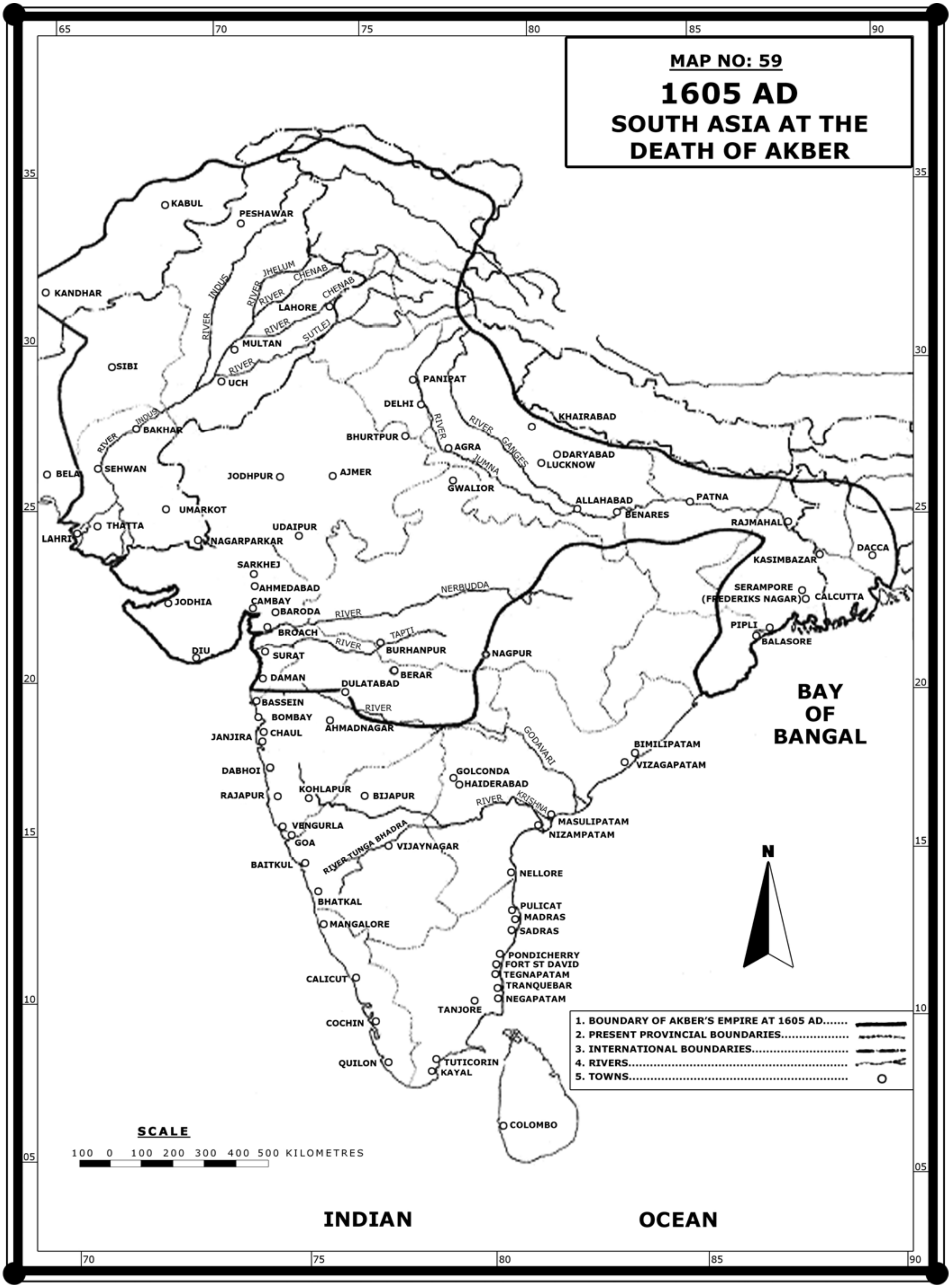
The Portuguese were in occupation of Lahri Bunder in 1613 AD when English made an attempt to open a factory there and as protest against it the Portuguese threatened to quit. The governor was in a difficult situation as he was bound to pay a fixed sum as share of custom duty to the king and the Portuguese were the main tax payers. In 1656 AD Manucci saw a Portuguese church at Lahri Bunder. In the centuries preceding the year 1500 AD Arabs and Persians including Persian Jews (up to 1228 AD) had acquired the position of predominance in the sea-borne trade of the whole South Asia – from Mozambique to Straits of Malacca. They had settlements at most of the posts and value of their trade to local authorities was so great that they were welcome and also enjoyed special favours. The Portuguese ousted out these Muslim traders from their predominant positions in the Indian Ocean.

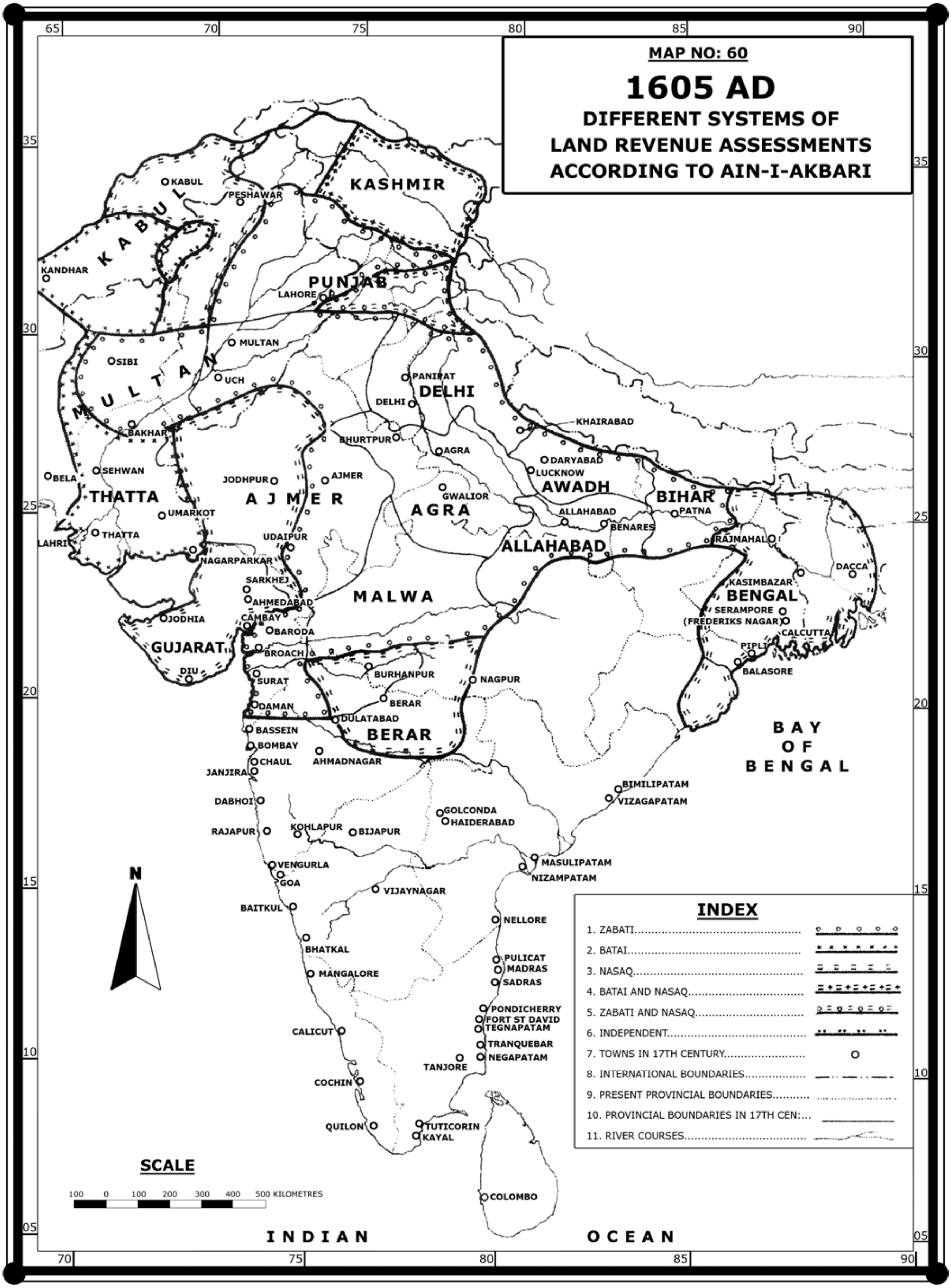
The items of trade invariably included spices, which in fourteenth century meant; drugs, dyes, perfumes, unguents, cosmetics, expensive articles of food, eleven types of sugars, many waxes, gums, glue, aromatics, condiments, preservatives, pepper (red, white and black), Capsicum, cinnamon etc., numbering to two-hundred-and-eighty-eight items as per Pegoaltti's hand book for merchants.

Lahri Bunder came into being between 1228 and 1333 AD after fall of Debal and probably due to change in the course of the River Indus. The port on the river was unsuitable and the site may have changed a few times. Sindh's export trade with Portuguese consisted of not only articles from Sindh, but also from the Punjab, NWFP and Afghanistan. This did include wine, drugs and timber from Kashmir; wheat, calico and opium from Sindh and the Punjab; salt, rice and indigo from Sindh and opium from Afghanistan. Sindh also exported sugar to Persia and Arabia. The imports into Sindh and on way beyond to north were: silver, gold, metals ware, glass, porcelain, horses and spices.

Since irrigation suffered badly cotton production dwindled. From 1550 AD onwards Sindh saw the migration of textile community from Sindh to other areas of the South Asia, but sufficient number remained in Sindh to support cotton textiles business.

Interestingly enough these migrant Memons retained Sindhi – called Memoni – as their mother tongue for nearly five hundred years. They call themselves from Thatta (Sarkar), which then meant the lower Sindh, and Halar (Hala Parguna), which meant the central Sindh.


MAP NO: 59
1605 AD
SOUTH ASIA AT THE
DEATH OF AKBER
KABUL
PESHAWAR
KANDHAR
LAHORE
MULTAN
SIBI
UCH
BAKHAR
SEHWAN
BELA
UMARKOT
THATTA
LAHRI
NAGARPARKAR
JODHPUR
AJMER
UDAIPUR
SARKHEJ
AHMEDABAD
CAMBAY
JODHIA
BARODA
BROACH
DIU
SURAT
DAMAN
BURHANPUR
BERAR
NAGPUR
DULATABAD
BASSEIN
BOMBAY
JANJIRA
CHAUL
AHMADNAGAR
DABHOI
RAJAPUR
KOHLAPUR
BIJAPUR
GOLCONDA
HAIDERABAD
VENGURLA
GOA
VIJAYNAGAR
BAITKUL
BHATKAL
MANGALORE
CALICUT
COCHIN
QUILON
TUTICORIN
KAYAL
TANJORE
COLOMBO
NELLORE
PULICAT
MADRAS
SADRAS
PONDICHERRY
FORT ST DAVID
TEGNAPATAM
TRANQUEBAR
NEGAPATAM
MASULIPATAM
NIZAMPATAM
BIMILIPATAM
VIZAGAPATAM
PANIPAT
DELHI
BHURTPUR
AGRA
GWALIOR
KHAIRABAD
DARYABAD
LUCKNOW
ALLAHABAD
BENARES
PATNA
RAJMAHAL
DACCA
KASIMBAZAR
SERAMPORE
(FREDERIKS NAGAR)
CALCUTTA
PIPLI
BALASORE
RIVER INDUS
RIVER JHELUM
RIVER CHENAB
RIVER SUTLEJ
RIVER JUMNA
RIVER GANGES
RIVER NERBUDDA
RIVER TAPTI
RIVER
GODAVARI
RIVER KRISHNA
RIVER TUNGA BHADRA
BAY
OF
BANGAL
N
1. BOUNDARY OF AKBER'S EMPIRE AT 1605 AD.......
2. PRESENT PROVINCIAL BOUNDARIES...................
3. INTERNATIONAL BOUNDARIES...........................
4. RIVERS...
5. TOWNS...
SCALE
100 0 100 200 300 400 500 KILOMETRES
INDIAN
OCEAN
65
70
75
80
85
90
35
30
25
20
15
10
05


MAP NO: 60
1605 AD
DIFFERENT SYSTEMS OF
LAND REVENUE ASSESSMENTS
ACCORDING TO AIN-I-AKBARI
KASHMIR
KABUL
PESHAWAR
KANDHAR
PUNJAB
LAHORE
MULTAN
SIBI
UCH
PANIPAT
DELHI
BAKHAR
KHAIRABAD
BHURTPUR
AGRA
DARYABAD
LUCKNOW
BELA
SEHWAN
JODHPUR
AJMER
AWADH
GWALIOR
BIHAR
THATTA
UMARKOT
ALLAHABAD
BENARES
PATNA
LAHRI
UDAIPUR
RAJMAHAL
NAGARPARKAR
DACCA
SARKHEJ
KASIMBAZAR
AHMEDABAD
MALWA
BENGAL
JODHIA
CAMBAY
SERAMPORE
(FREDERIKS NAGAR)
BARODA
CALCUTTA
GUJARAT
BROACH
PIPLI
DIU
BURHANPUR
BALASORE
SURAT
NAGPUR
BERAR
DAMAN
DULATABAD
BASSEIN
BAY
OF
BENGAL
BOMBAY
CHAUL
AHMADNAGAR
JANJIRA
BIMILIPATAM
VIZAGAPATAM
DABHOI
GOLCONDA
HAIDERABAD
RAJAPUR
KOHLAPUR
BIJAPUR
MASULIPATAM
NIZAMPATAM
VENGURLA
GOA
N
VIJAYNAGAR
BAITKUL
NELLORE
BHATKAL
PULICAT
MADRAS
SADRAS
MANGALORE
PONDICHERRY
FORT ST DAVID
TEGNAPATAM
CALICUT
TRANQUEBAR
NEGAPATAM
TANJORE
COCHIN
QUILON
TUTICORIN
KAYAL
COLOMBO
INDIAN
OCEAN
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2. BATAI
3. NASAQ
4. BATAI AND NASAQ
5. ZABATI AND NASAQ
6. INDEPENDENT
7. TOWNS IN 17TH CENTURY
8. INTERNATIONAL BOUNDARIES
9. PRESENT PROVINCIAL BOUNDARIES
10. PROVINCIAL BOUNDARIES IN 17TH CEN:
11. RIVER COURSES
SCALE
100 0 100 200 300 400 500 KILOMETRES
65
70
75
80
85
90
35
30
25
20
15
10
05

MAP NO: 61

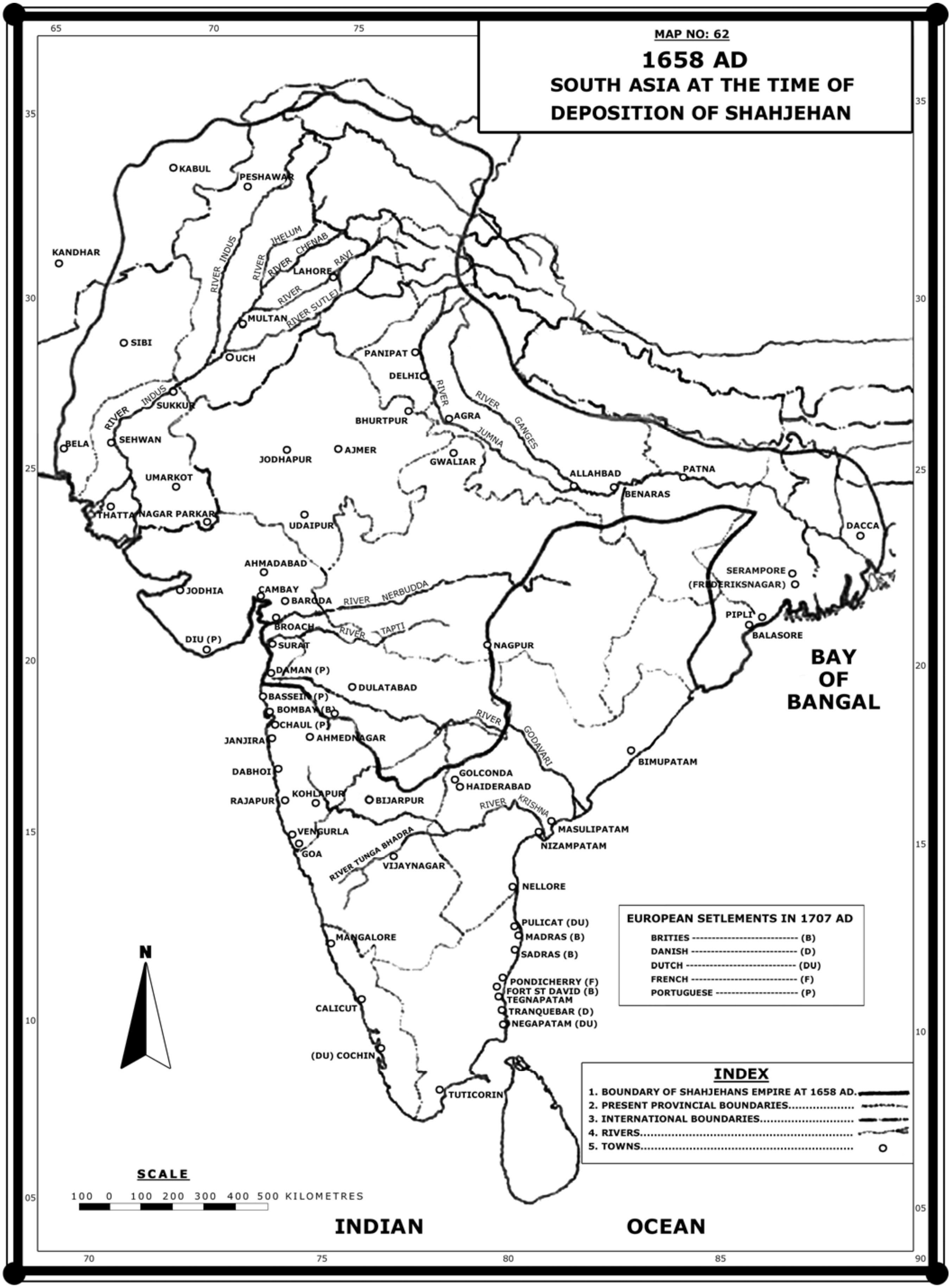
1608-1700 AD

ADMINISTRATIVE MAP OF SINDH

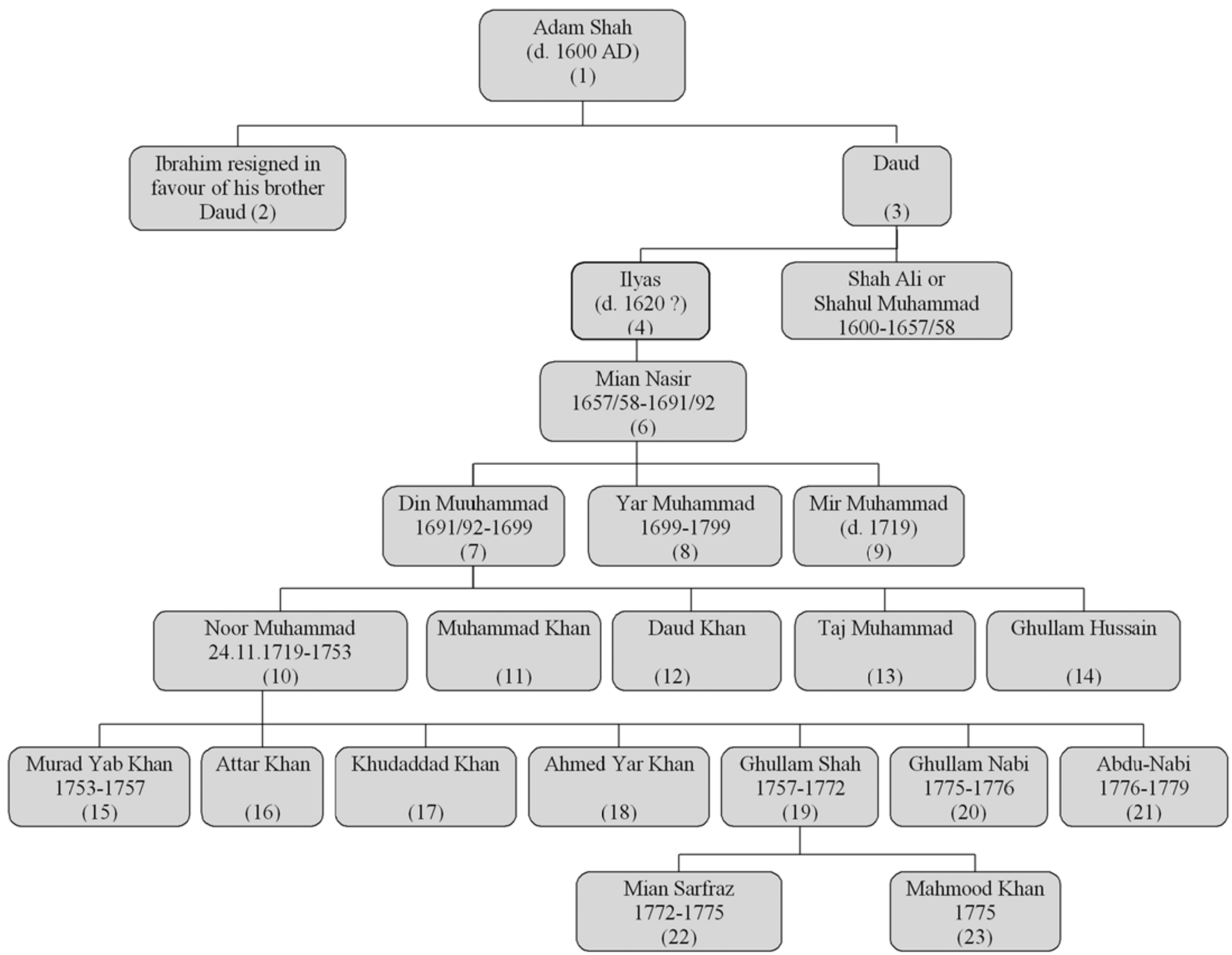
MAP NO: 62

1658 AD

SOUTH ASIA AT THE TIME OF DEPOSITION OF SHAHJEHAN



CHRONOLOGICAL TABLE OF KALHORA DYNASTY



CHAPTER 28

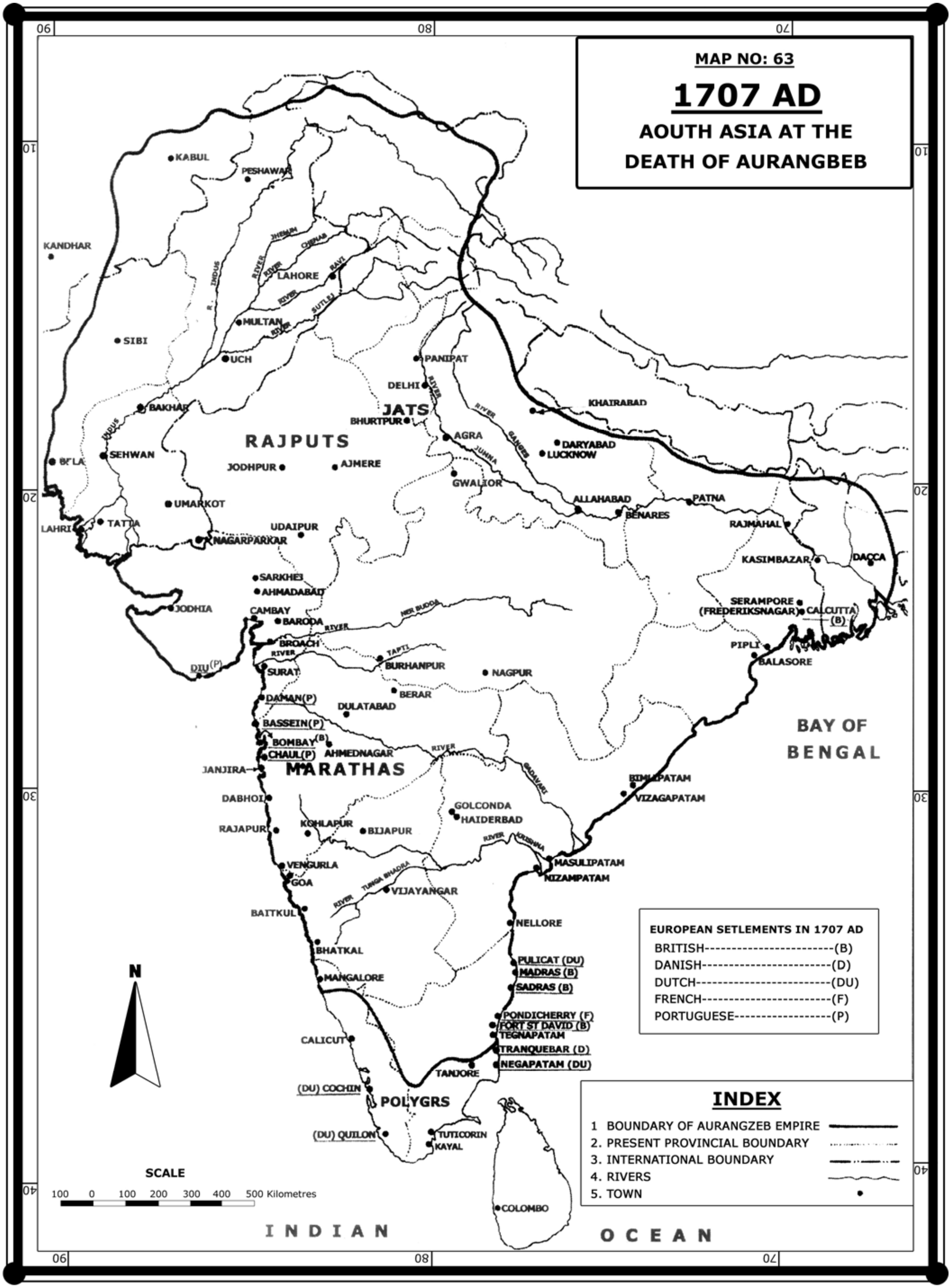
IRRIGATION UNDER KALHORAS; 1701 - 1783 AD

Kalhoras' rise to power is connected with Sindhi tribes' struggle to acquire agricultural land, which since 1522 AD under Arghoons, Tarkhans and Mughal governors, had been allotted to the Jagirdars and Mansabdars most of whom according to Mirak were unfamiliar with agriculture as such more so with the irrigated agriculture and construction as well as maintenance of canal system in Sindh. Majority of Sindhi tribes had been under rebellion and had resorted to animal husbandry based on pastoral economy. Only a few tribes and clans favourably placed for irrigation such as those in Larkana and northern Dadu and Thatta districts remained attached to irrigated agriculture. From the scattered references it appears that a local tribal-head a Panhwar after the decline of power of Sehwan governor had assumed the power of local governor and had improved irrigation system to some degree, but majority of the tribes yet remained aloof and did not participate.

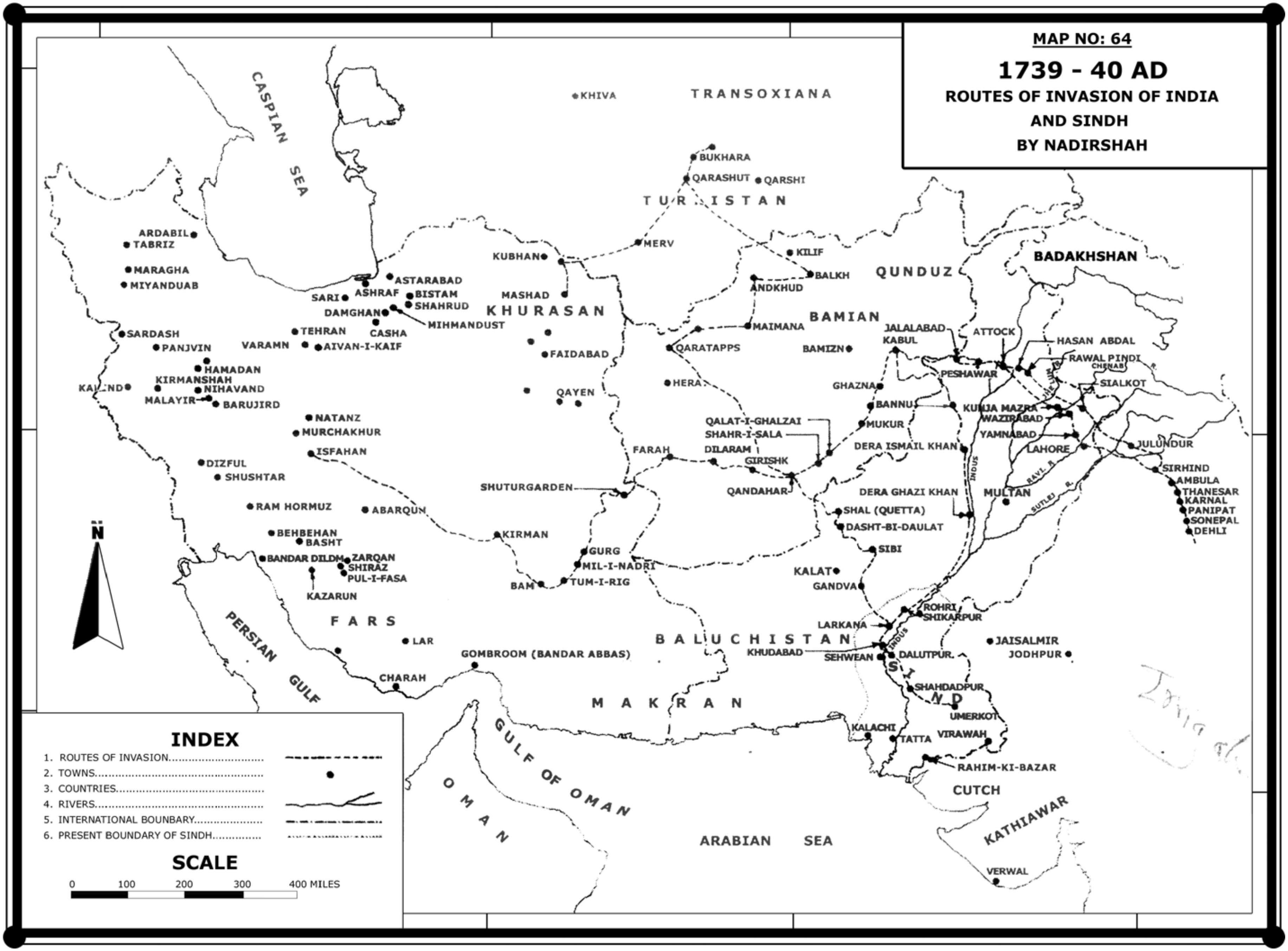
Samma tribes, which had legitimately fought against the conquerors for 175 years (1522- 1700 AD) and had turned pastorals did not have leadership and were scattered. They did not contest for the power due to the lack of central leadership. It was during the chaotic conditions that Kalhoras rose to power replacing Panhwars in northern Dadu district. Kalhoras had put more than a century's struggle against Mughals. They were hereditary Pirs and their followers were mostly Balochis of D.G. Khan, Muzaffargarh, Sibi and Kachhi. They also had Sindhi followers from north-western Sindh. They were master canal builders and constructed and renovated 700 to 1000 canals from 1701 to 1754 AD as we will see hereafter. They occupied present Larkana and northern Dadu districts and made Shikarpur (Khudabad) their capital. The Mughal governor of Multan the eldest son of Emperor Aurangzeb as a compromise accepted them as official governors in 1701 AD. Kalhoras kept advancing season by season and occupied more and more territories. By 1837 AD they were masters of the whole of Sindh.

Chart attached gives their genealogy and the rulers of their dynasty:

No. 1.	Was killed on orders of Mughal governor of Multan.
No. 2.	Resigned in favour of his younger brother - No. 3.
No. 4.	Had occupied private lands in Chanduka or Larkana district.
No. 5.	Forcibly occupied lands of Sangis and Abras and was killed in a war with the governor of Bakhar. By end of his times in 1657 AD they probably had full control over whole Larkana district except Rato Dero and Miro Khan talukas.
No. 6.	Started occupying more and more lands in Mehar and Kakar talukas, but was arrested by Mughals in a battle with Mir Muhammad Panhwar of Garhi who was helped by Mirza Khan governor of Sibi. He was sent to Delhi wherefrom he was allowed to return back on some terms and conditions, which later on he did not honour. He took Lakhat on contract from the governor of Sehwan. He also occupied Magan Mori and the Sahiti in present Nawabshah district. His headquarters were at Garhi.
No. 7.	He defeated Panhwars near Markhpur taluka Dadu and occupied Fatehpur a town of Mir Panhwar. He was able to defeat Amir Sheikh Jehan who was sent from Delhi to punish him near Guerelo Warah taluka. He was called by Muizuddin (grand son of Aurangzeb and governor of Multan) and executed.
No. 8 and No. 9	While No. 7 was under arrest No. 8 defeated Mughal troops of Muizuddin on the bank of river Gaj on the border of Dadu and Johi talukas, but soon patched up with the Mughal governor. He also


MAP NO: 63
1707 AD
AOUTH ASIA AT THE
DEATH OF AURANGBEB
EUROPEAN SETLEMENTS IN 1707 AD
BRITISH------------------------(B)
DANISH------------------------(D)
DUTCH------------------------(DU)
FRENCH------------------------(F)
PORTUGUESE------------------(P)
INDEX
1 BOUNDARY OF AURANGZEB EMPIRE
2. PRESENT PROVINCIAL BOUNDARY
3. INTERNATIONAL BOUNDARY
4. RIVERS
5. TOWN
SCALE
100 0 100 200 300 400 500 Kilometres
N
INDIAN
OCEAN
BAY OF
BENGAL
RAJPUTS
JATS
MARATHAS
POLYGRS
KABUL
PESHAWAR
KANDHAR
LAHORE
MULTAN
SIBI
UCH
BAKHAR
SEHWAN
UMARKOT
TATTA
LAHRI
NAGARPARKAR
JODHPUR
AJMERE
UDAIPUR
SARKHEJ
AHMADABAD
JODHIA
CAMBAY
BARODA
BROACH
DIU (P)
SURAT
DAMAN (P)
BASSEIN (P)
BOMBAY (B)
CHAUL (P)
JANJIRA
DABHOL
RAJAPUR
VENGURLA
GOA
BAITKUL
BHATKAL
MANGALORE
CALICUT
(DU) COCHIN
(DU) QUILON
TUTICORIN
KAYAL
COLOMBO
TANJORE
NEGAPATAM (DU)
TRANQUEBAR (D)
TEGNAPATAM
FORT ST DAVID (B)
PONDICHERRY (F)
SADRAS (B)
MADRAS (B)
PULICAT (DU)
NELLORE
NIZAMPATAM
MASULIPATAM
VIJAYANGAR
KOHLAPUR
BIJAPUR
GOLCONDA
HAIDERBAD
AHMEDNAGAR
DULATABAD
BERAR
BURHANPUR
NAGPUR
VIZAGAPATAM
BIMLIPATAM
BALASORE
PIPLI
CALCUTTA (B)
SERAMPORE (FREDERIKSNAGAR)
KASIMBAZAR
DACCA
RAJMAHAL
PATNA
BENARES
ALLAHABAD
LUCKNOW
DARYABAD
KHAIRABAD
GWALIOR
AGRA
BHURTPUR
DELHI
PANIPAT
RIVER INDUS
RIVER JHELUM
RIVER CHENAB
RIVER RAVI
RIVER SUTLEJ
RIVER JUMNA
RIVER GANGES
NER BUDDA RIVER
TAPTI RIVER
GADAVARI RIVER
KRISHNA RIVER
TUNGA BHADRA RIVER

	acquired Sibi and Kachhi from Mughals against regular tribute. For helping Azam Khan governor of Thatta against Sufi Inayat whose presence at Jhok had threatened local landowners and also the Syeds of Bulri. He was awarded Lakrhi, Dando, Hajam, Dorank, Rajab, Pisar, Pajath, Thor, Dub, Jhol etc., i.e., present southern Nawabshah, Sehwan, Kotri, Mahal Kohistan, Thatta and Karachi talukas. He was made Mansabdar and Nazim of Delhi Darbar by the Mughal court.
No. 10	Under No.10 whole Sindh was re-unified for the first time in 200 years. He ousted out Daudpottas from Shikarpur in battles of 1723-1726 AD. He acquired Thatta Sarkar at Rs.3 lacs from its last governor Sadiq. Karachi was bought form Khan of Kalat. Uprisings of Shoras were suppressed thus, consolidating his power over Kohistan conquered by No. 8. Daudpottas were also removed from the Island of Dubli on the Indus in 1727/28. The latters established themselves in Bahawalpur. In 1739 AD he had wars with Jam of Kakrala and Dharejas of coastal region, but without any consequences. They were finally conquered in 1744 and 1747 AD respectively. Fort of Kanji belonging to Kutch was conquered and annexed in 1746 AD. Desert areas of Sindh were taken from Sodhas and Samejas. Set back to the advancement of Kalhoras came in 1739 AD when Nadir Shah defeated Muhammad Shah the Mughal emperor and took control of all territories west of the Indus and Nahar Sankra (western Puran). Nadir Shah ceded Shikarpur to Daudpottas and Sibi-Kachhi-Dera Jutt to the Khan of Kalat. He was made tributary chief and titled as Shah Kuli Khan and Baigi. After Nadir Shah's murder in 1747 Ahmed Shah Durrani (Abdali) took over eastern territories of the empire (Sindh included) and Noor Muhammad was awarded title of Shah Nawaz. Noor Muhammad was still planning the annexation of more areas as he purchased 15 guns from the East India Company at Rs. 29,700 in 1848 AD.
	Daudpottas were ousted out from Shikarpur in 1745 under the instructions of Nadir Shah. It came to be controlled directly by Nadir Shah for two years and by Durranis subsequently.
No. 15	No. 15 Muradyab succeeded No. 10 in 1754 AD. He built new capital town and named it as Muradabad. This short-lived town was eroded by the Indus in 1757 AD.
No. 16 to No. 18	Some hydrological changes started in the River Indus around 1755-56 AD. The river re-established itself in its new course from Hala to west of Hyderabad and down to the sea along almost its present channel abandoning its old course, which went from Hala to Oderolal, Nasarpur, Shaikh Bhirkio, Jun, Old Badin and Rahimki to Koree Creek. The area under irrigated agriculture in 1753 AD was 2.1 million acres, which was reduced to about 1.1 millions by this change of the river. Such major changes in Sindh have invariably caused fall of the governments and change of dynasties. The first rebellion was started by the Balochi chiefs and was also supported by masses. Muradyab was replaced by Ghulam Shah No. 19 as ruler after brief rule of No. 16.
No. 19	No. 19 was able ruler and annexed some territories near the Sindh coast and also had three expeditions against Kutch from some ports of which he brought enormous booty.
No. 22	Noor Muhammad Kalhora was allocated Sibi and Dhadhar and his son Ghulam Shah was given D.G. Khan, D.I. Khan and also Multan for a short time by Ahmed Shah Abdali. Noor Muhammad Kalhora occupied the whole Sindh between 1718-1738 AD and used Baloch hill-tribes for recruitment of his soldiery. In return he gave their chiefs Jagir lands in Sindh.
No. 22	No. 22 succeeded No. 19, built a large Sarfaraz canal, which survived up to 1932 AD, but people were in rebellion due to loss of 1.0 million acres. He was replaced by No. 20 and 21, but the loss of irrigated land by the river brought an end of dynasty in 1783 AD.


MAP NO: 64
1739 - 40 AD
ROUTES OF INVASION OF INDIA
AND SINDH
BY NADIRSHAH
CASPIAN SEA
KHIVA
TRANSOXIANA
BUKHARA
QARASHUT
QARSHI
TUR ISTAN
MERV
KILIF
BALKH
ANDKHUD
QUNDUZ
BADAKHSHAN
BAMIAN
MAIMANA
QARATAPPS
HERA
BAMIZN
JALALABAD
KABUL
ATTOCK
HASAN ABDAL
RAWAL PINDI
CHENAB
SIALKOT
PESHAWAR
GHAZNA
BANNU
KUNJA MAZRA
WAZIRABAD
YAMNABAD
LAHORE
JULUNDUR
MUKUR
QALAT-I-GHALZAI
SHAHR-I-SALA
DILARAM
GIRISHK
DERA ISMAIL KHAN
INDUS
RAVI R.
SUTLEJ R.
SIRHIND
AMBULA
THANESAR
KARNAL
PANIPAT
SONEPAL
DEHLI
MULTAN
DERA GHAZI KHAN
QANDAHAR
FARAH
SHAL (QUETTA)
DASHT-BI-DAULAT
SIBI
KALAT
GANDVA
ROHRI
SHIKARPUR
LARKANA
KHUDABAD
SEHWEAN
DALUTPUR.
JAISALMIR
JODHPUR
SIND
SHAHDADPUR
UMERKOT
KALACHI
TATTA
VIRAWAH
RAHIM-KI-BAZAR
CUTCH
KATHIAWAR
VERWAL
ARABIAN SEA
BALUCHISTAN
MAKRAN
GULF OF OMAN
OMAN
ARDABIL
TABRIZ
MARAGHA
MIYANDUAB
SARDASH
PANJVIN
KALIND
KIRMANSHAH
HAMADAN
NIHAVAND
MALAYIR
BARUJIRD
VARAMN
TEHRAN
AIVAN-I-KAIF
SARI
ASHRAF
ASTARABAD
BISTAM
SHAHRUD
DAMGHAN
CASHA
MIHMANDUST
KUBHAN
MASHAD
KHURASAN
FAIDABAD
QAYEN
NATANZ
MURCHAKHUR
ISFAHAN
DIZFUL
SHUSHTAR
RAM HORMUZ
ABARQUN
SHUTURGARDEN
KIRMAN
GURG
MIL-I-NADRI
TUM-I-RIG
BAM
BEHBEHAN
BASHT
BANDAR DILDM
ZARQAN
SHIRAZ
PUL-I-FASA
KAZARUN
FARS
LAR
GOMBROOM (BANDAR ABBAS)
CHARAH
PERSIAN GULF
N
INDEX
1. ROUTES OF INVASION
2. TOWNS
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4. RIVERS
5. INTERNATIONAL BOUNBARY
6. PRESENT BOUNDARY OF SINDH
SCALE
0
100
200
300
400 MILES

Their secret lay in quick restoration of the canal system and settlement of farmers thereon. There are different estimates as to the area under cultivation in Sindh under Kalhoras. Lambrick thinks that they had achieved figure of three million acres, while Chablani considers it as 2.1 millions. The present writer accepts conservative estimate of 2.1 million acres as each acre of land needs and supports about 1.5 persons in rural community and Sindh's population could not have been more than three millions by about 1757 AD when under Kalhoras cultivation reached its zenith. Which canals did Kalhoras build? could be worked out only through research. Sir Charles Napier's canal department had collected some records, which soon were lost. No attempt was ever made to put this information together again.

On the basis of some available information Kalhoras excavated the following canals:

- Shah-ji-kur; constructed by Shah Baharo vizier of Noor Muhammad Kalhoro.
- Nasrat Wah; excavated by Nasrat Khan Chandio in the days of Noor Muhammad Kalhoro.
- Murad Wah; excavated by Murad Khan Kalhoro.
- Feroz Wah; excavated by Feroz Vir during Kalhora dynasty's rule.
- Sarfaraz Wah; excavated by Mian Sarfaraz Kalhoro.
- Bagh Wah; excavated by Bagh of Sial clan, which clan was brought to Sindh from the Punjab by Kalhoras.
- Noor Wah from Begari canal; excavated by and named after Noor Muhammad Kalhoro.
- Noor Wah from Ghar; excavated during Noor Muhammad Kalhoro's rule.
- Noor Wah from Western Nara; also excavated during Noor Muhammad Kalhoro's rule was in general perennial as was Western Nara canal in its lower reaches where it could supply water by gravity. The same Noor Wah was later on given mouth from the Indus near Nasrani above Pat by the British. This Noor Wah supplied water to their capital Khudabad.
- Begari; as the name implies excavated by statutory or forced labour may have been commissioned during the early Kalhora rule from which canal Noor Wah and Sone Wah the two branch canals took off.
- Shar Wah; after tribe "Shar" now merged in Guddu Barrage as Sharkot branch.
- An unknown canal; abandoned by Talpurs and renovated as Briggs Wah.
- Rajab Ghitti (Gath Wah).
- Maksuda Wah; which once filled Sindh Dhoro and went in disuse under Talpurs was commissioned by Jacob and called Jacob Wah. It was given final shape as desert canal in 1873 AD.
- Sone Wah; above mentioned, from Begari.
- Mirza Wah.
- Gurang Wah; which even today is an independent inundation canal taking off from the River Indus in northern Sindh.
- Ghar; appears to be a natural drain to the Indus from the torrents of Kachho hills may have been commissioned by Kalhoras or may even have been Abro canal of Samma period.
- Western Nara; was natural branch of River Indus and was in commission during Kalhora-Talpur rule.
- Date-ji-kur; constructed by Dato Khuhawar.
- Shah-ji-kur; constructed by Noor Muhammad Kalhoro.
- Naulakhi, Dad and Dhambhro; all old channels of River Indus converted into canals by Kalhoras.
- Gungro; a natural branch of Indus, which may have been commissioned by Kalhoras after 1758 AD when Indus took the present course below Hala.
- Baghar; a natural branch of Indus in 1699 AD may have become a non-perennial stream after 1758 AD and therefore may have been commissioned as canal by Mian Ghulam Shah Kalhoro.
- Same could be said of Ochto or Hajamro and Kalri canals.
- Three canals from Makhi Dhandh namely Mithrao, Din and Heran; which started operating when Fife gave new mouth to the Eastern Nara above Rohri may have been old canals belonging to Samma-Soomra period and may have flowed occasionally as and when spill waters from the Indus and the Sutlej discharged into the Eastern Nara. They were probably in use occasionally during Ghulam Shah Kalhora's rule as reportedly he was the one who took care that no spill water from Eastern Nara reached Kutch via Puran. Many of old canals belonging to Kalhora-Talpur and British periods were absorbed in the new canal systems of Guddu, Sukkur and Kotri barrages. Only by extensive local investigations at the level of Subdivisional Engineers could the antiquity and history of old

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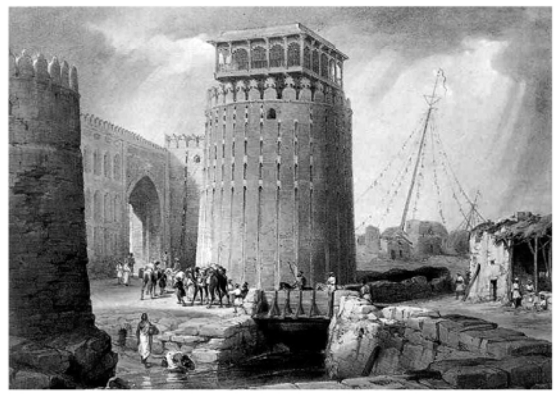

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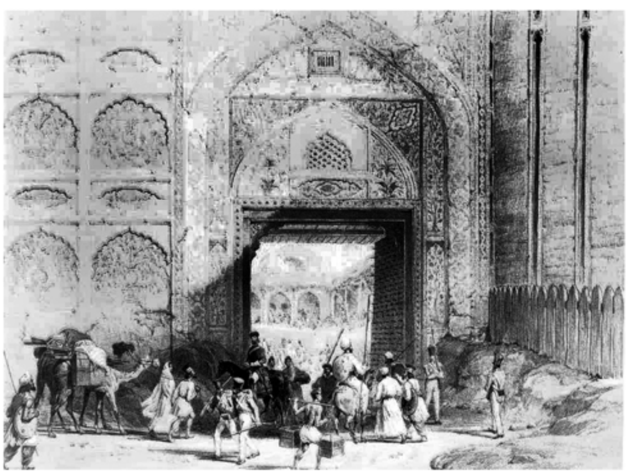

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VIEWS OF HYDERABAD FORT

847. A view of Hyderabad fort (Pacca Qila) (SALU).
848. Main guard and Government House, Hyderabad fort, 1771 AD.
849. North-West Front of Hyderabad fort, 1771 AD.
850. The Round Tower of Hyderabad fort, 1771 AD.
851. Main Gateway of Hyderabad fort, 1771 AD.
852. View from the Round Tower of Hyderabad fort, 1771 AD.
853. Shaikh Makai fort, Hyderabad, 1758 AD (Kacha Qila).

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canal system be ascertained.

- Unfortunately this study does not have any engineering applicability so the department will have little use for it. It is hoped that some day economic and social historians and anthropologists would undertake this study.
- Total number of canals under Kalhoras may have reached a figure of 700-1,000 by about 1754 AD. Kalhora period's irrigated agriculture reached a minimum area of 2.1 million acres by 1758 AD, but a major hydrological change took place then. Post-Little Ice Age warm climate and increase in river flows caused hydrological changes in the River Indus around 1755/56 AD. The river re-established itself in its new course from Hala to west of Hyderabad and down along its present channel abandoning its old course, which went from Hala to Oderolal, Nasarpur, Shaikh Bhirkio, Jun, old Badin and Rahimki to Koree Creek in 1758 AD. This change left about 500 canals operative above Hala and an equal number abandoned below this place.

The area under irrigated agriculture in 1753 AD was 2.1 million acres, which was reduced to about 1.1 million acres by this change of river.

Ghulam Shah's claim was challenged by Ahmed Yar Khan and Attur Khan. The latter was able to obtain a Sanad (authority to rule) from Ahmed Shah Durrani and Ghulam Shah vacated in his favour. Attur Khan could not manage the affairs primarily as hydrological changes were still in process and the river had not fully established itself. The Balochi chiefs therefore re-invited Ghulam Shah who defeated his two brothers and they withdrew. So he assumed the throne unchallenged in 1759 AD. Settlement started on the new lands commendable by the new course of the River Indus. In normal times such a process takes fifty years. To replenish the treasury he launched a number of invasions on Jam of Kakrala in 1760 AD and Kutch in 1761-62 AD and again in 1864/65 AD conquering and annexing Kakrala, Sindhri (in Rann of Kutch – submerged and destroyed in earthquake of 1819 AD), Lakhpat and Basta and thus bringing large area of the Rann of Kutch under his control. In the meantime internal feuds held Kalhoras in their grip for the next 25 years when Talpurs replaced this dynasty. The British historians seem to have had great regard for the canal management of Kalhoras and even as late as 1937 AD Lambrick stated that by 1930 AD within 87 years of their rule the British had just achieved what Kalhoras had already done by the mid-eighteenth century.

By 1758 AD even if Lambrick's figure of three millions irrigated acres is replaced by Chhablani's conservative estimate of 2.1 millions acres Sindh's population would be about three millions. Chhablani thinks that around 1600 AD area under cultivation in Sindh was 1.3 million, which in accordance with rate of taxation, yield per acre and price of grain fetched the government of the day comes 66, 215, 395 as reported in Ain-i-Akbari. This would put Sindh's population at 1.9 million souls in 1600 AD. Under Aurangzeb considering the fact that revenue from Thatta Sarkar in 1665 AD had reduced to twenty percent of that in 1600 AD despite inflation the area under cultivation in Sindh must have further reduced to about 0.5 million. It is fair to assume that before Kalhora dynasty gained power in Sindh in 1701 AD its population could not have been more than 1.2 million and area under cultivation about 0.7 million acres.

Again knowing the circumstances between 1522 and 1701 AD it could be stated that under Sammas total population may have been 2.4 millions and the area under cultivation 1.6 million acres. In the intervening 175 years not only Sindh's area under cultivation reduced, but also the population. The same was to repeat between 1758 and 1843 AD due to new circumstances for which very detailed data, records, reports and travel accounts exist. This is the Talpur period discussed hereafter.

CHANGE OF COURSE OF RIVER INDUS AND DECLINE OF KALHORA POWER IN SINDH - CONSEQUENCES OF THE 1758-1783 AD

The change in the course of River Indus in 1758 AD brought down the canals' cultivation from 2.1 millions to 1.1 million acres. Simultaneously cold prevailed again specially after 1760 AD and the area under cultivation could not be increased substantially. It became apparent that the food production would reduce to half; the population will also reduce to half and would thus lead to starvation, diseases and deaths. It thus resulted into struggle for existence. The Kalhora rulers felt that Balochi tribes brought by them and settled as Jagirdars were too powerful for them and tried to crush their power. The Balochi tribes on the other hand saw that they could save their kith and kin from starvation if they could usurp most of the lands. It was a case of Darwin's "Struggle for Existence". It really was a civil war, which had it

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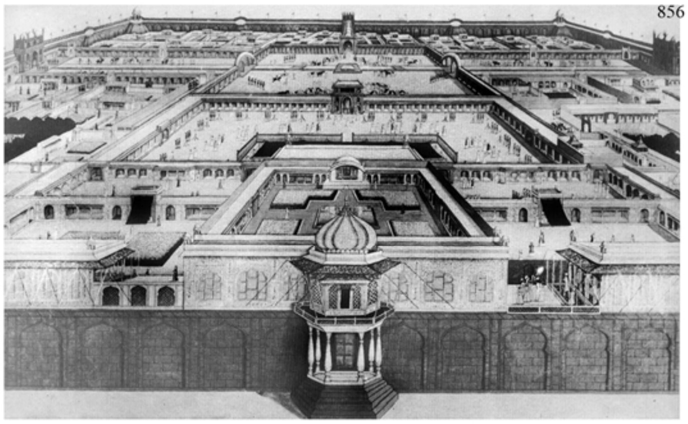

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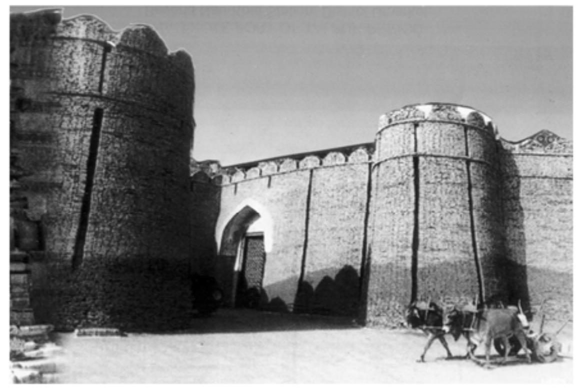

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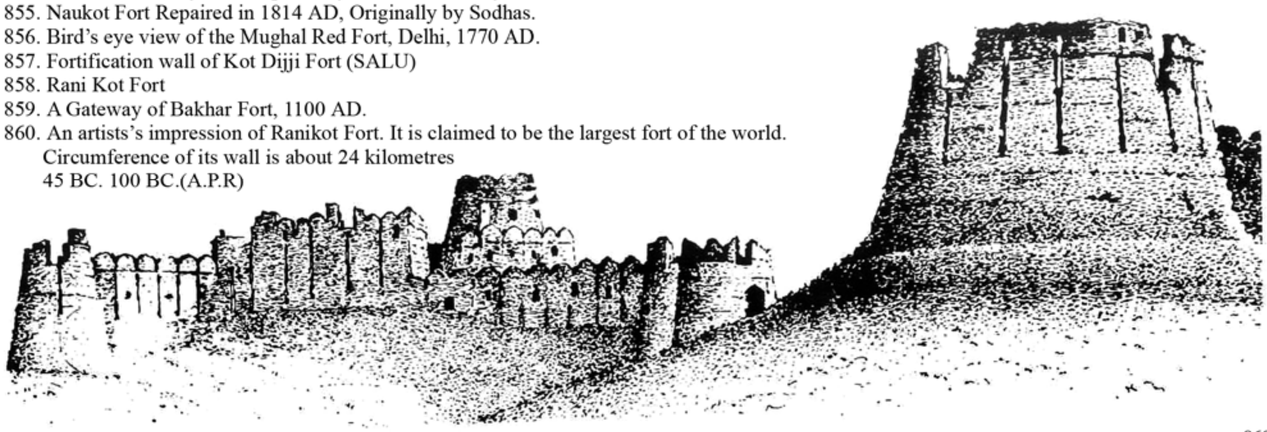
UMERKOT, NAUKOT, KOT DIJJI, RANIKOT, BAKHAR AND MUGHAL RED FORT

854. Umer Kot Fort by Sodhas probably more than 1000 years old.
855. Naukot Fort Repaired in 1814 AD, Originally by Sodhas.
856. Bird's eye view of the Mughal Red Fort, Delhi, 1770 AD.
857. Fortification wall of Kot Dijji Fort (SALU)
858. Rani Kot Fort
859. A Gateway of Bakhar Fort, 1100 AD.
860. An artists's impression of Ranikot Fort. It is claimed to be the largest fort of the world.
Circumference of its wall is about 24 kilometres
45 BC. 100 BC.(A.P.R)



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origins in replacement of Mian Muradyab Khan with Ghulam Shah and now resulted into open fight with the rulers who also used various tactics including invitation to Madad Khan who in turn looted the whole Sindh to crush the power of Balochi chiefs. In the final round Talpurs ousted out the Kalhoras and distributed most of the lands among themselves. Some Zamindars were allowed to retain the land on payment of tax. The population, which in 1758 AD was about three millions, reduced to 1.4 million as British saw in 1843 AD. The British blame Talpurs for mismanagement of irrigation system. This allegation is hardly true because the levels of water in the river due to cold spell, which continued up to 1850 AD, were so low that Kalhoras' canals, which were six yards wide, had reduced to one third of their width. Kalhoras' increasing area under cultivation was on account of high level of water in the River Indus, which acted as incentive. The initiative came essentially from the cultivators who volunteered labour to dig and de-silt the canals so that they may be able to switch from nomadic pastoral economy to settled agricultural one. This incentive was absent during the Talpurs' rule. Mirs did construct canal south of Hala. There is no doubt that they contributed towards irrigation within their means i.e., availability of water and its level in the Indus. In the whole process of Kalhora-Talpur strife the party that suffered the most was the cultivators who no longer had water available for their lands and turned to pastoralism and gradually succumbed to death as adequate pasture was not available. In reduction of population from 3.0 millions to 1.4 million it was they who faced death and starvation as the area under cultivation reduced from 2.1 millions acres to 0.9 million acres. Hari or tenant-cultivator was a backbone of irrigated agriculture in Sindh and he had invariably suffered by climatic hazards during the past eight millennia.

In brief neither Kalhoras nor Talpurs are to be blamed for what happened. It was case of "Struggle for existence" and "Survival of the fittest" of the parties to survive under the conditions where every second person was to die of starvation. The cultivated area was reduced to half by the change of course in the River Indus and cold spell had prevailed from 1758-1850 AD in which river level was low, canals did not flow full capacity and area under cultivation was not increasing fast enough to reverse the situation.

In brief when every second person is to die there is no morality; who kills whom. This is the rule of “Struggle for existence" and "Survival of the fittest”. Neither Kalhoras nor Talpurs can be blamed for the massacres of each other on flimsy or false excuses. Both stand equally exonerated.

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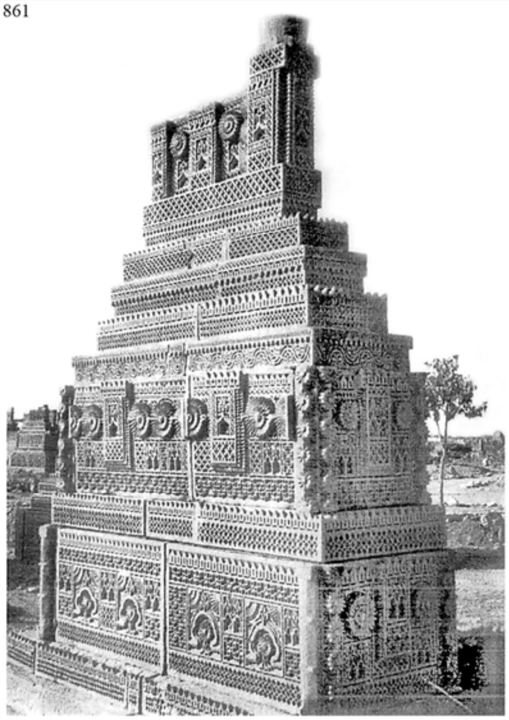

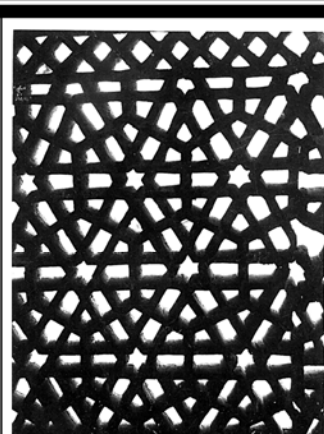

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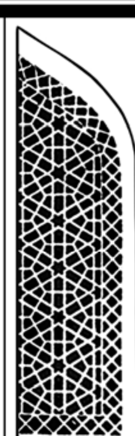

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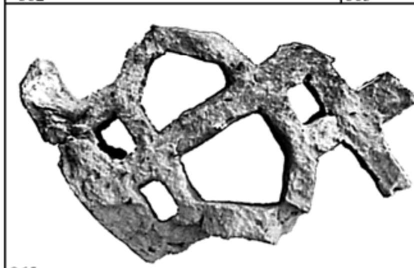

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CHAUKANDI AND TERRACOTTA GRILLS

861. Chaukhandi tomb art in 14th to 18th centuries evolved from earlier stone craving and was influenced by Samma, Arghoon, Turkhan and Mughal stone craving. The so called sun-flower motif is lily, as sun-flower did not exist in the Old World and was brought to South Asia by the Portuguese in the 16th century.

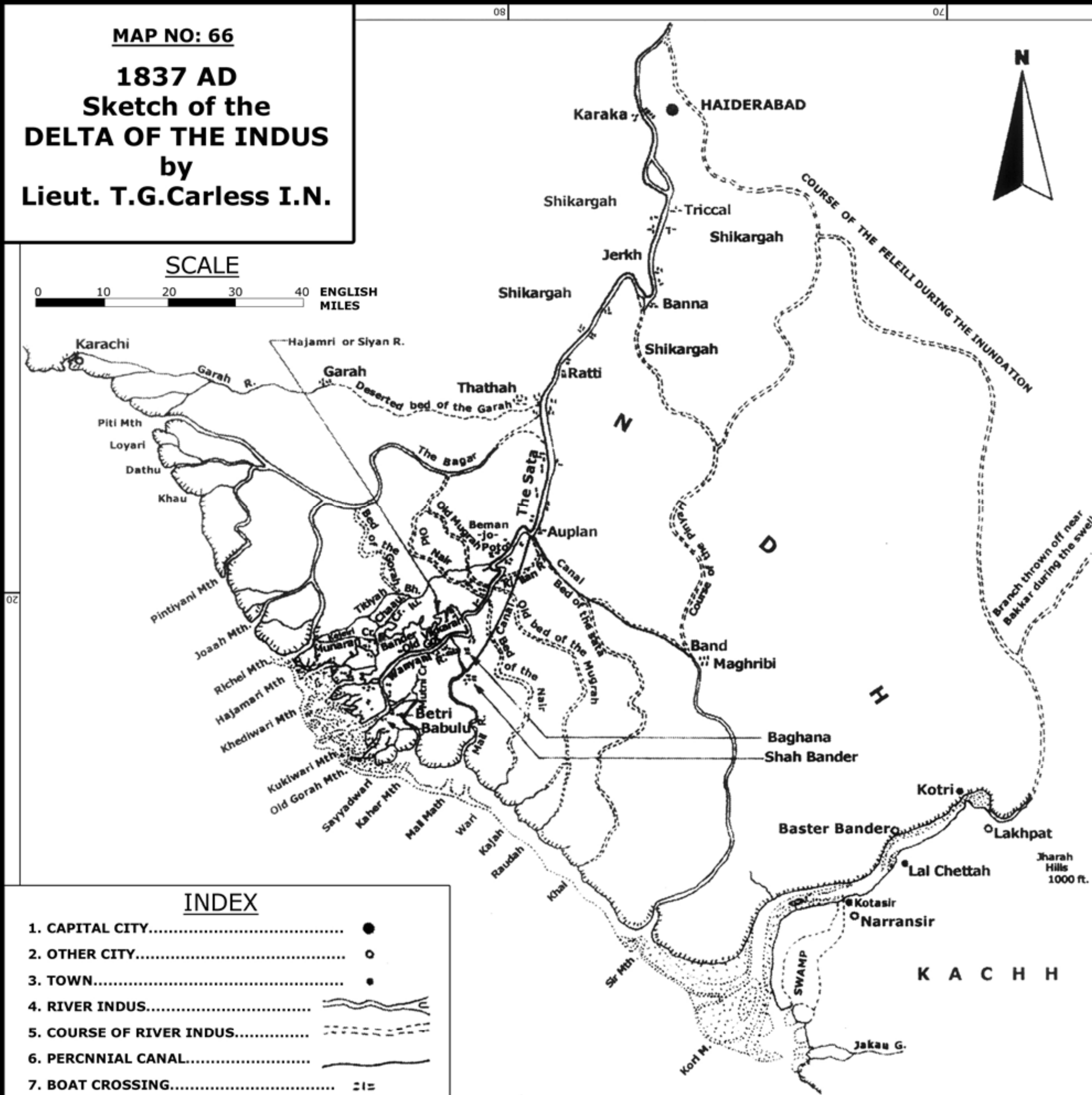
862 & 863. Geometrical designs show the same source of inspiration.

864. Die cast brick with notches or Kungro. Brick or tile probably for grave or parapet wall of a building or cornice. It is stamped with a tool producing ring shaped flowers. (Lar museum, Badin).

865. Burnt clay grill peace. (Lar museum, Badin).

MAP NO: 66

1837 AD Sketch of the DELTA OF THE INDUS by Lieut. T.G.Carless I.N.



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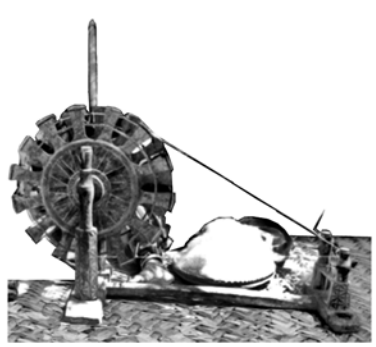

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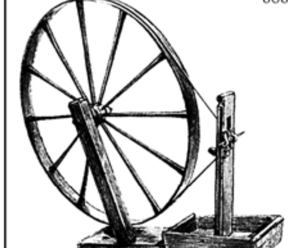


INDUSTRIAL TOOLS

866. Oil expeller.
(Sindh Museum,Hyderabad).
867. Spinning wheel.
868. Spinning wheel of 18th century.

CHAPTER 29

IRRIGATION UNDER TALPURS; 1783 - 1843 AD

Talpurs claim their origin from Iran. This is true to the extent with other Balochi clans around the 10^{th} century AD. They entered Sindh about five centuries later. They descend from an ancestor named Tal and called Talpur (Tal-pubra). In Sindh they were settled on the Kachho lands at mountain foot hills of Dadu and Larkana districts. They fought Mughal governors of Sehwan in early seventeenth century. Later on they became disciples of Kalhora saints. In the seventeenth century when anti-Mughal movement started due to deterioration of irrigational system they joined as Kalhoras' mercenaries.

Mian Nasir Kalhora conquered lands in Kambar, Kakar and Johi talukas with help of Balochi tribes and settled them on these lands. Kalhoras knowing irrigation system well constructed more than 700 canals to irrigate these lands. They accepted Kalhoras as their spiritual guides and as a symbol of gratitude of permanently settling them on the rich fertile lands. The Baloch chiefs were being buried at the graveyard of Mian Nasir located eight miles north-west of Kakar at Garhi in Dadu district until recently. The aerial view of this graveyard is extremely impressive in spite of lack of decoration and poor workmanship of the tombs. The ancestors of Balochi chiefs, Kako and Hatak and Manek belong to seventeenth century. Of the supporters of the Kalhora cause Mir Shahdad Khan (d. 1734 AD) the founder of Shahdadpur was the first Talpur chief to come into lime light. Like-wise his cousin founded Tando Allahyar town. Bahram Khan and his brother Chakar Khan were important courtiers of Ghulam Shah's period. To win favour of warring tribes (Balochis) Kalhoras adopted the Mughal system of Jagirdari or Mansabdari. In place of cash payment for services jagirs were awarded to various chiefs who had to clear canals, collect land revenue, raise army, maintain law and order, impart justice and also pay a fixed amount of revenue to Kalhoras rulers.

TALPURS' RISE TO POWER AND DIVISION OF SINDH

Hydrological changes in 1855-58 AD deserted half of the Sindh's irrigated areas. Talpurs finding their lands without water lost patience, interfered in Kalhora ruling family affairs and installed new rulers always to their advantage to get lands, which had assured supply of water from other tribes.

On Noor Muhammad's death the Baloch chiefs installed as well as removed Muradyab Khan and put his other brothers and finally Ghulam Shah in his place. On latter's death they became an unformidable force. In the conquest of Sindh from Kalhoras in the civil war between 1774 to 1783 number 9, 10, 11, 12, 13 had played leading role. On establishing their power Sindh was divided in seven parts of which; four parts went to Fateh Ali and his three brothers (Nos. 9, 10, 11 and 12) hereafter called Hyderabad Mirs; one part to Mir Sobdar (No.13) called Khairpur Mirs and two parts to Mir Tharo (No.14) called Mankani Mirs of Mirpurkhas. The other Balochi chiefs were given jagirs all over Sindh. These three Talpur branches acted independently in all matters except for foreign relations, which Hyderabad Mirs were authorised to settle. The four Mirs of Hyderabad held a joint court in the mornings and individual courts in the afternoons.

Fateh Ali (No.9) died in 1802 AD. Then Ghulam Ali (No.10) assumed as the chief.

There was a battle between Mir Ghulam Ali and Mir Tharo, which the latter lost and was wounded, but the former had him treated and sent him back to Mirpurkhas. Ghulam Ali (No.10) died in 1811 AD without leaving a male issue and Karam Ali (No.11) became the chief of Hyderabad Mirs and ruled well. On his death in 1828 AD the fourth brother Mir Murad Ali became the successor chief of Hyderabad. On Mir Murad Ali's death in 1833 AD his son Mir Noor Muhammad and other son Mir Nasir Khan was

made co-ruler for certain functions. Mir Noor Muhammad died in 1839 AD and Mir Nasir succeeded as the chief ruler of Hyderabad, who was defeated by the British and exiled - an act of breach of trust with Talpurs. This petty war of Big Power was condemned even by the English people, but the British did not return Sindh to Talpurs as cabinet, in words of Gladstone, "Had decided that mischief of retaining it was more than mischief of returning it." By mischief he meant advantage.

Following were rulers of Talpur families of Sindh:

TALPUR FAMILY (HYDERABAD BRANCH)

Mir Fatah Ali	1784/85 – 12th May 1802
Mir Ghulam Ali	19th May 1802 – 17th June 1812
Mir Karam Ali	17th June 1812 – 30th December 1828
Mir Noor Muhammad Mir Nasir (jointly)	21st October 1833 – September 1839
Mir Nasir	21st October 1833 – September 1839

TALPUR DYNASTY (KHAIRPUR BRANCH)

Mir Sohrab	1784/85 – 17th August 1830
Mir Rustam	1830 – 20th December 1842
Mir Murad Ali (under British Paramountcy)	1842 – 1894

TALPUR DYNASTY (MIRPURKHAS BRANCH)

Mir Tharo	1784/85 – 1829/30
Mir Murad Ali	1829/30 – 1836/37
Mir Sher Muhammad	1836/37 – February 1843

The Talpurs had bad luck that cold spell continued during their rule and even up to 1850 AD. During simple irrigated agriculture in arid river valleys without knowledge and application of levelling equipment and excavating machinery must absorb about 1.4 to 1.6 persons in rural community for rvery acre cultivated. The proportion must have remained constant over centuries and only in recent years under British had it decreased in Sindh due to application of engineering skills that helped in design of canals, which required lass labour for silt clearance once canal is constructed. It reduced length of canals per unit of land brought under command. Periodic flooding of cultivated lands eliminated by construction of flood protective embankments and elimination of labour spent in re-levelling and reclaiming such lands flooded in preceding years. Reduction in animal husbandry as alternative occupation due to lack of pasturelands, which came under plough, made rural labour surplus. This in turn led to development of towns and cities.

Assuming acreage and rural population ratio as 1:1.5 the population of Sindh could be determined for various periods if rough acreages under cultivation are known. For the past one-hundred-and-forty years these figures are known, but correct picture could be had only by study of figures up to 1931 when industrialisation to absorp large manpower had not yet come in Sindh and Sukkur Barrage had not started flowing. The ratio for these years is 1.64 to 1.18 persons per acre of land for the early British period and is worked out from table given on next page.

Since area under cultivation was 0.9 million acres during the last days of Talpur rule it could be concluded that population of Sindh could not have been more than 1.4 millions in 1843 as against three millions in 1757 AD. Increase in population over 15 years between 1843 and 1858 could be considered reasonable. There are numerous causes of decline of population over these 85 years (1758-1843) and for this the Talpurs cannot be wholly absolved from the responsibility.

Besides the reports, which are purely engineering in nature, there are keen observations pf early English administrators who have also a word of praise for Talpur administration of law and order and justice, but regarding irrigation they are unanimously of the opinion that it was neglected by the Talpurs. A few interesting comments are reproduced below:

a) James Hughes, Deputy Collector Shikarpur, in a report on Praguna of Chanduka-1847 states that:

- Chanduka was divided among the sons of Ghulam Ali, Fateh Ali and Murad Ali. This was one of the main causes of ruination of irrigation of the area, which depended upon the same source from the Indus i.e., Ghar.
- Country north of Garhi Khairo was desolate – villages in ruins and canals choked up. Still the landscape showed evidence of farmer property.
- West of Datah Canal, constructed by Dato Khuhawar, marks of farmer cultivation were striking.
- Shahdadkot, an important town on Datah Canal, had turned into ruins and one Hindu was sole

Year	Population	Area under cultivation (acres)	Ratio of acreage to population
1856	1, 882, 502	1, 200, 000	1.56
1872	2, 333, 527	1, 419, 000	1.64
1881	2, 542, 976	1, 602, 000	1.58
1891	3, 003, 711	2, 203, 000	1.36
1901	3, 410, 223	2, 808, 000	1.21
1911	3, 737, 223	2, 733, 000	1.36
1921	3, 472, 508	2, 939, 000	1.18
1931	4, 114, 253	3, 060, 000	1.34
Sourses: Census reports, Bombay Presidency – Volumes 1892-1931 Sindh, Census Reports, Sindh, 1941 and Gazetteer of Sindh, 1907.			

occupant of the whole town.

- Punoon settlement in the same area was also in ruins.
- On Shah Canal, constructed by Noor Muhammad Kalhora, there were traces of cultivation. It gave large revenue to early Mirs, but in 1846 the whole area was in ruins except near its mouth. In 1824 Mir Shahdad ordered Rs. 10,000 to be spent on the canal, but the work was never carried out.
- Farmers on these canals have migrated for want of water.

b) Richard Burtons notes forwarded by Captain Baker, Superintendant of Canals and Forests, mention:

“Almost every canal in Sindh was in depleted condition wanting besides engineering skill (unknown to Sindh dynasties) silt clearance everywhere to bring more land under cultivation, which was deserted so recently. Canals needed not only widening of their heads, but also the tails.”

c) Postans in “Personal Observations on Sindh”, London-1843, explains:

- Production qualities of Sindh were not estimated by its possessors.
- The real position of population under Talpur government was never estimated and it caused mismanagement.
- Grant of land to chieftains for military service.
- Mirs seldom did canal clearance and the Sindh Canal, leading to the important trade town of Shikarpur and the area surrounding it, was so completely neglected that it was nearly choked up.

d) Richard Burton in 1851 in “The Races that inhabit the Valley of Indus” states that the Ryot (cultivator) was cheated by three sets of government superiors: Amirs, who wished to collect maximum revenue with minimum excavation (de-silting) of canals; the Kardars (Tehsildars or Mukhtiarkars), who exacted as much from Amirs as possible and paid as little as possible for excavating work to Ryot or farmer, who compulsorily had to help in de-silting the canals against payments – with a result that many canals originally Chaugazo (four yards wide) had shrunk to half or one third. The third party to cheat was Ameens, who were to settle claims of cultivator against Kardars for earth-moving job. The Ameen was so poorly paid that he always allowed himself to be bought by Kardar. Besides these he mentions:

- Faulty slopes of canals.
- Banks were kept perpendicular and walls readily fell in once soaked by flowing water.
- Excavated earth was dumped close to canal bank, which obstructed further clearance.
- Improper judgment in selecting heads of canals and no attention paid to prevent widening of canals.
- Large canals like Guni, Phuleli, Ghar and Nara, which were old beds of the river or its branches, were never cleared out resulting into reduced supplies in the next season.
- Many watercourses ran five to seven miles in parallel before fanning out, because they were carrying water to two different landowners.

It is true that in 1758 AD irrigation system below Hala was destroyed, but by 1843 AD a network of canals up to the sea had been established and this must have been done during the time of latter

Kalhoras or early Mirs. The latter Mirs neglected canal clearance causing reduction in area under cultivation and consequent reduction in population caused by malnutrition and famines. Two famines occurring in the northern Sindh in 1820 and 1822 are reported by Bhatia.

Besides this negligence Mirs and their Jagirdars had great craze for hunting. Large tracts of agricultural land in production were allowed to turn into forest for this pastime. Thus, by 1843 AD, the concluding year of their rule, the area under cultivation stood reduced to about 0.9 million acres and the population to about 1.4 millions. The population figure given by different scholars differ from each other: Chhablani (1951), at 1.5 millios; Postan (1843), at one million; Dr. Burnes (1828), at one million; Del Hoste (1855), at 0.8 million and Pottinger (1843), at 0.9 million.

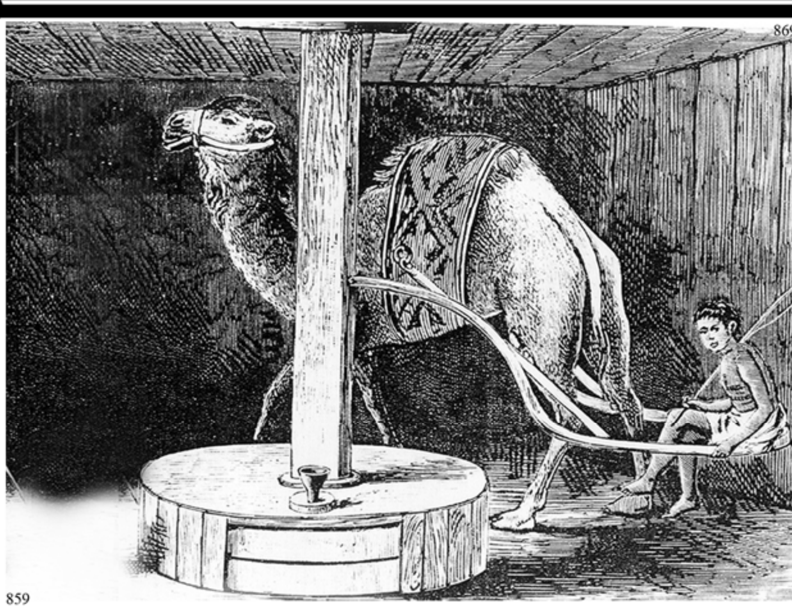
Appendix-I shows the list of 729 canals in 1876 AD. Of these almost all belong to either Kalhora or Talpur period, except Ford, Briggs and Jacob Wahs. Even some of these were improvements or renovations of old Talpur canals. The cultivation figure in 1876 AD was 1.5 million acres against 0.9 million at the end of the Talpur period. The increase was primarily because of timely de-silting of canals and slopes given by means of dumpy level rather than by naked eye. Many revolutionary engineering improvements in the irrigation system of Sindh, including the largest single canal network of Sukkur Barrge, were to come later on.

Mirs did excavate some new canals often named as Mir Wahs. Mir Nasir of Hyderabad and Mir Sohrab of Khairpur both promoted canals. The length of Kalhora-Talpur canals surviving in 1843 and improved up to 1873 was 5,529 miles as detailed in appendix-I. The Mirs charged water tax for maintaining feeder canals built by them. This tax was known as Hakba or water rate. The rates of assessment or land revenue tax varied with the kind of irrigation and various classes of taxes were:

a) Moke or irrigation by gravity flow; at Rs. 2.0 per baiga (in the last days of Mirs).
b) Charkhi or lift by Persian wheel; at Rs. 1.0 per baiga.
c) Bosi, in which case low-lying land was flooded and when water recede a crop was raised on preserved moisture, the rate was in between (a) and (b).

These rates were extremely high looking to the fact that a century later rates charged for Sukkur Barrage irrigated lands were much lower than these in spite of inflation.

The crops grown were the same as under Kalhoras or before opening of Sukkur Barrage i.e., rice, cotton, wheat, sugarcane, oil seeds and pulses. Mir Karam Ali Talpur had allowed the Portuguese to open a church at Karachi in 1818 AD and allotted them some 640 acres of land on Lyari River. Here they introduced guava, cherimoya, peas, potato, sweet potato, maize and peanuts and from there they spread to the whole Sindh.


869
859


870

FLOUR MILLS

869. Flour-mill pulled by camel. Grinding of grain to flour was women's job, but in towns with large population of labour without accompanying females flour was ground in animal powered large grinding wheels. This was common up to 1920 AD when diesel engines replaced animal power. (Baille, Karachi).

870. Domestic flour-mill with flour container. Until end of 20th century rural women of Sindh had to grind flour needed by family, daily for couple of hours. (Sindh Museum, Hyderabad).

CHAPTER 30

THE PARTIAL BRITISH ATTEMPTS AGAINST IRRIGATED DESPOTISM

The old system of agriculture, as we know of under Mughals, was feudal despotism under which a government nominee called by different titles but in effect a Jagirdar was assigned one or more canals and lands towards his upkeep, maintenance of sepoys for law and order, collection of taxes and for payment of certain amount to the central government's treasury. On this land were settled many petty chiefs or Zamindars or Waderas (literally meaning small chiefs) who in turn were responsible for management of watercourses and distribution of water within their jurisdiction. The irrigation system before the British had always needed plenty of labour for excavation of new works, repairs, maintenance of old works and de-silting of canals at least once annually. Such labour was kept at the disposal of the feudal lord by petty chiefs (Waderas) under his jurisdiction. To manage this properly the local chief had Kamdars (work controllers or foremen) who in turn were able to organise and draw upon free or forced labour from among the cultivators of their lands. This team of free labour got only one free meal at noon during the working day from the local chief. The labour force available free of charge called Chher was officially abolished by General John Jacob the Acting Commissioner in Sindh in 1856, but in reality continued in practice until thirty years ago. Even today it is used occasionally for de-silting of field watercourses.

The British assumed the power of chief or Jagirdar by the following methods:

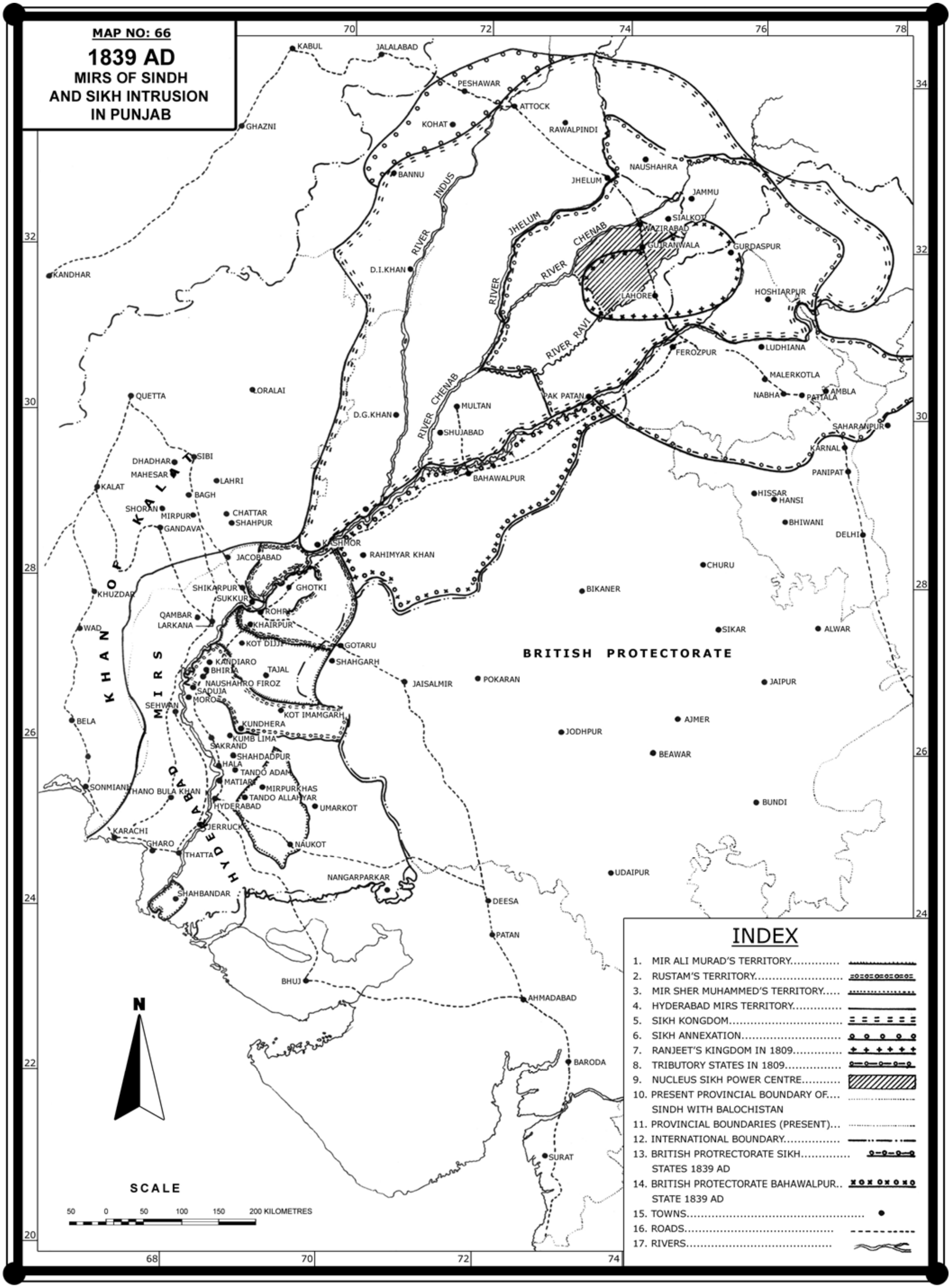
All land for which no water was available was considered government land.

If the land could be cultivated either by regular or irregular supply of water it was leased to Zamindar for a certain period or sold to him outright.

When land was leased out the allottee had to pay annual lease money and if it was sold out the allottee had to pay the cost as well as annual land revenue.

If the government supplied water the allottee had to bear expenses for development and management of water in shape of water rates charged every year.

The institution of Zamindari was not done away with. Zamindars' powers to exact forced labour from cultivators were curtailed, but were not completely controlled. So much was the tyranny of the system that in 1918 AD the Bombay Government had to set up a committee to enquire into "Rassai", "Lapo" and "Chher" in Sindh. Their four volume report runs over some 1500 foolscap papers (34 x 20 cms). The agency to develop and supply irrigation water was agro-managerial bureaucracy. Though it took over some of the functions of Jagirdar or feudal despot it was not despotic in nature; primarily because it did not resort to the use of forced labour nor did it exercise judicial and tax collecting powers. Moreover to maintain efficiency of the system distribution of water was made on equitable grounds to all landowners on a canal. This was an important social change and according to Carl Marx amounting to almost a revolution never heard of in Asia until British introduced it in the latter part of nineteenth century. The irrigation system so envisaged provided new possibilities for non-totalitarian development and these are still in evolutionary stage, but its remarkable achievement is gradual emancipation of the cultivator during the past seventy years.


MAP NO: 66
1839 AD
MIRS OF SINDH
AND SIKH INTRUSION
IN PUNJAB
KABUL
JALALABAD
PESHAWAR
ATTOCK
KOHAT
RAWALPINDI
GHAZNI
BANNU
NAUSHAHRA
JHELUM
JAMMU
SIALKOT
WAZIRABAD
GUJRANWALA
GURDASPUR
LAHORE
HOSHIARPUR
KANDHAR
D.I.KHAN
RIVER INDUS
RIVER JHELUM
RIVER CHENAB
RIVER RAVI
FEROZPUR
LUDHIANA
MALERKOTLA
NABHA
PATIALA
AMBLA
QUETTA
LORALAI
PAK PATAN
MULTAN
D.G.KHAN
SHUJABAD
SAHARANPUR
KARNAL
PANIPAT
BAHAWALPUR
DHADHAR
SIBI
MAHESAR
LAHRI
KALAT
BAGH
SHORAN
MIRPUR
CHATTAR
SHAHPUR
GANDAVA
HISSAR
HANSI
BHIWANI
DELHI
KASHMOR
RAHIMYAR KHAN
JACOBABAD
CHURU
KHUZDAR
SHIKARPUR
SUKKUR
GHOTKI
BIKANER
QAMBAR
LARKANA
ROHRI
KHAIRPUR
WAD
SIKAR
ALWAR
KOT DIJJI
GOTARU
SHAHGARH
BRITISH PROTECTORATE
KANDIARO
BHIRIA
TAJAL
NAUSHAHRO FIROZ
JAISALMIR
POKARAN
JAIPUR
SADUJA
SEHWAN
MORO
KOT IMAMGARH
KHAN OF KALAT
MIRS
BELA
KUNDHERA
KUMB LIMA
AJMER
JODHPUR
SAKRAND
SHAHDADPUR
BEAWAR
HALA
TANDO ADAM
SONMIANI
MATIARI
MIRPURKHAS
THANO BULA KHAN
TANDO ALLAHYAR
UMARKOT
BUNDI
HYDERABAD
JERRUCK
KARACHI
NAUKOT
GHARO
THATTA
NANGARPARKAR
UDAIPUR
SHAHBANDAR
DEESA
PATAN
BHUJ
AHMADABAD
BARODA
SURAT
N
SCALE
50 0 50 100 150 200 KILOMETRES
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CHAPTER 31

EARLY IRRIGATION UNDER THE BRITISH; 1843 - 1932 AD

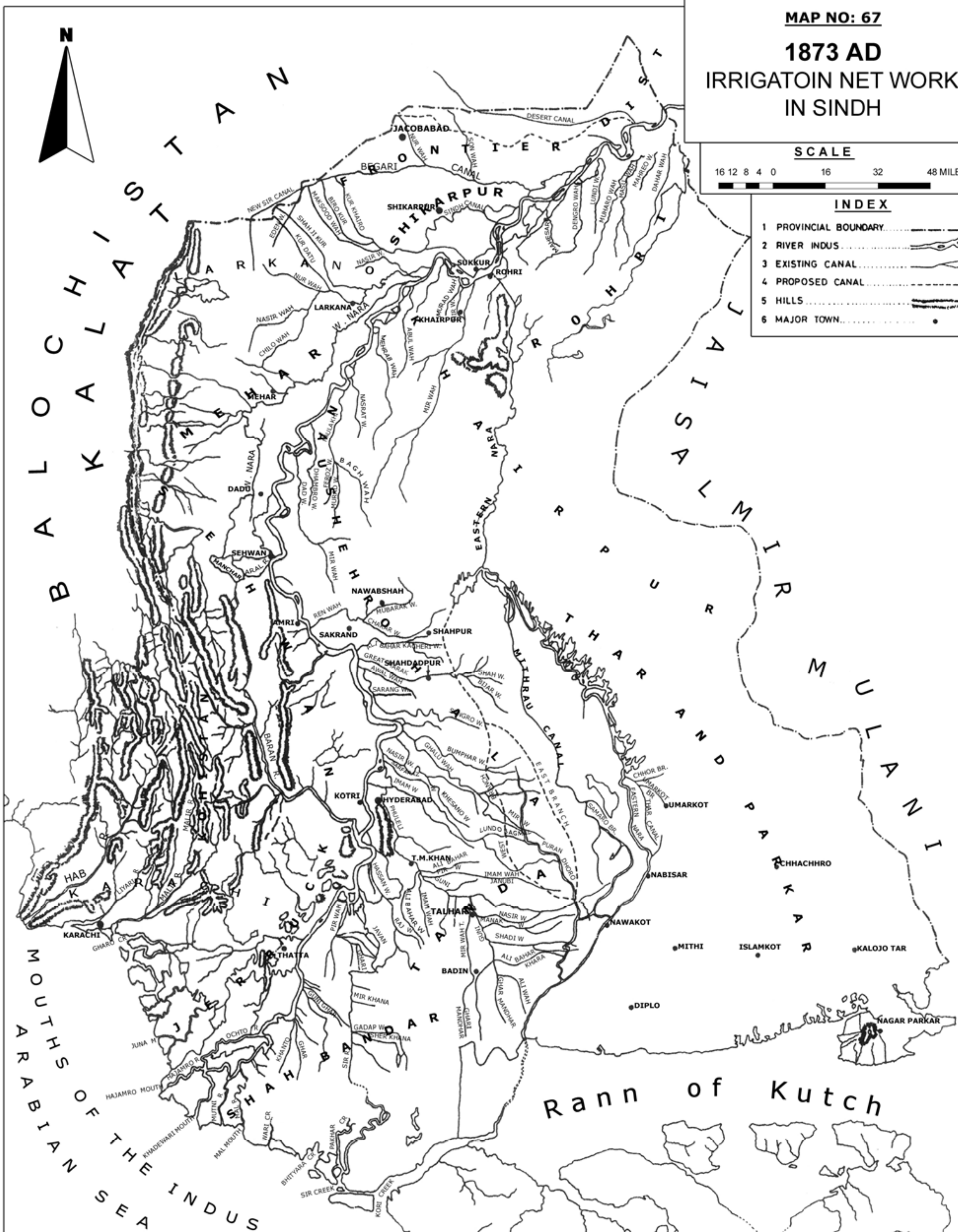
The British on conquest of Sindh inherited canal network, which already was not in good shape, but the change also brought an immediate decay of the system as Charles Napier's officers took time to understand that. Canal clearance was an important annual operation without which canals won't carry full discharge and would even choke.

Sir Charles Napier who had conquered Sindh in 1843 organised a combined Canal and Forest Department and put it under charge of Lt. Col. Walter Scott of Bombay Royal Engineers, but no useful work could be done by this engineer as the officers given to him in charge of canals were mostly non-engineers and as a result the department was abolished in 1849. He however studied the then existing canal system, identified the main defects of the old system and made certain recommendations for its improvement, but no progress was made beyond this. The main point of this report worth mentioning is his recommendations about the proposed Rohri-Hyderabad canal, which he considered neither technically feasible nor economically viable. One of the early surveyors in the department was Richard Burton (later on Sir) who in his off duty hours kept studying what can be termed as anthropology of Sindh and it was published in a number of reports. He also developed a thorough knowledge of working of canals as is discussed in his various writings. John Jacob in charge of North Western Frontier (Jacobabad district) had improved irrigation in his district between 1843-1951 and as per his advice Bartle Frere the Commissioner in Sindh organised Canal Department under Col. Blios Turner. General John Jacob not only improved the then Begari Canal of upper Sindh, but the excavation of Desert Canal then called Maksudabad or Maksud Wah the second biggest canal of upper Sindh. It was he who got the project of Desert Canal prepared and forwarded to government in year 1855. The project however could not be carried out until year 1873.

J.G. Fife was appointed as Superintending Engineer, Canal Department in 1855 and in 1859 he connected the Eastern Nara Canal with the river Indus by a link canal up-stream at Rohri. This link served up to 1932 and is still capable of bringing supplementary supplies to Nara Canal if needed any time. The contribution of this celebrated British engineer towards the canals system in Sindh is such that he is rightly remembered even today as the "Father" of irrigation system in Sindh. Fife for the fist time in the irrigation history of Sindh fully understood defects of inundation canals and proposed a solution in form of a scheme for perennial and assured irrigation water supply to Sindh. In his scheme, which is predecessor of Sukkur and Kotri Barrages, he suggested putting a weir at Rohri (Sukkur Barrage site) for taking one canal (Rohri) to irrigate the left bank and enter Phuleli Canal near Hyderabad and another canal from Sukkur to Manchar lake via Western Nara (to become predecessor of Dadu and Rice canals); a weir at Jherruck for a right bank canal (predecessor of Kalri Baghar) and a canal on left bank (a predecessor of Pinyari and Guni canals). He also suggested fifth canal from Eastern Nara to Wanga Bazaar (predecessor of Mithrao canal). Fife's report was rejected by the Bombay Government. Even if it had been accepted there was lack of experience of construction of barrage of this magnitude on any river similar to the Indus in width, depth and discharge any where in the World. The equipment to execute the works did not exist. Manufacture of mobile cranes, draglines and clam-shafts were another forty years away and diesel and petrol engines had yet to be developed to give required mobility to the equipment for construction. Excavation machinery as used for the first time for the construction of the Suez Canal by the French engineers in 1869 was not even dreamt of at the time of Fife's proposal in 1859 AD. For the Suez Canal 1.2 million labourers had been put to work ten years and 125,000 had lost their lives on the site.

MAP NO: 67

1873 AD
IRRIGATOIN NET WORK IN SINDH



ALL CANALS OF 1873 AD OR KALHORA-TALPUR WAHS AND ONLY TWO NEW NAMELY FORD WAH AND JACOB WAH WERE ADDED BETWEEN 1843 AND 1873 TO ALREADY EXISTING 727 CANALS. EVEN THESE TWO WERE INFACT OLD CANALS AND WERE RE MODELED TO CARRY MORE WATER.

If the proposal had been accepted yet it would have taken at least thirty years to design and build the equipment and construction completed at a cost higher than in 1932 as by the later date all kinds of excavation machines were already in use commercially.

The Great trigonometrical Survey of India, which produced contour maps of Sindh from 1860 AD onwards, brought an unusual advantage to the canal improvement. This too was not available when Fife proposed his system. The engineers could foresee the slopes and improve the inundation canals and their branches leading to improved water course of the farmers. The improvements carried out from 1855-1932 AD are detailed below:

RIGHT BANK OF INDUS

In upper Sindh the Maksuda Wah, Desert canal, Begari and Sindh Wah were the main inundation canal system. The Desert canal, which then was only thirty five miles in length, is now about sixty three miles long. The Begari canal whose year of origin may go back to Soomra-Samma period was only forty miles in length. Its branches were; Noor Wah, Sone Wah and Mirza Wah. Sindh canal was an old natural stream having head at that place which was never a successful one until new head provided by Fife.

NARA CANAL SYSTEM

Soon after taking over the charge Fife's attention was drawn to the failure of Nara River in bringing supplies for irrigation in Tharparkar District. The Nara River, which formed the part of Drishadvati-Sarsuiti-Hakra system, got dried up and general impression prevalent then was that certain influential people or tribes cut off supplies by erecting bunds and diverted the water for their use. The matter was investigated and it was established that no artificial diversion had taken place and that the supplies had been cut off on account of geological changes which occurred in its northern catchments 4,000 years ago. In order to meet the situation Col. Fife prepared the project of a link connecting Nara with river by an artificial channel upstream of the Sukkur-Bakhar-Rohri gorge. This link was called the Nara supply channel which was opened in 1859. The off-take of supply channel being upstream a narrow of gorge having the advantage of high levels even in low flow periods was expected to work as a perennial channel.

The project of right bank canal from Sukkur though much reduced in scope was accepted and work sanctioned in year 1861. Similarly the Mithrao canal project was also accepted and approved, but the project could not be completed before 1879.

ROHRI CANAL

The proposed Rohri-Hyderabad canal though not considered then for implementation was incorporated in the Sukkur Barrage project and is now known as Rohri canal – the premier canal of Sindh with hardly any parallel in the World.

JAMRAO CANAL SYSTEM

Another important canal project initiated by Col Fife was the Jamrao canal project which envisaged the construction of canal system Ex-Nara River for providing perennial irrigation. The project proposal was submitted in year 1860, but with competing projects like Rohri-Hyderabad canal, Sukkur canal and Mithrao canal projects the Jamrao canal project could not be pushed through and had to wait till year 1894 when the project was undertaken and completed in 1899 and inaugurated on 24th November 1899. Reverting back to Jamrao canal project it may be mentioned that it comprised of construction of a weir across the river Nara with Jamrao canal off taking from the bypass channel with gate under-sluices and the system being operated on the still pond principle. Thus Jamrao was the first ever weir controlled perennial canal in Sindh. In 1902-1904 after the completion of Jamrao canal project the major new canal projects worth mentioning were; Nasrat canal and Dad Wah, which were constructed between 1902-1904. The remodelling of Desert canal was also undertaken in this period.

UNAR CANAL

From 1884-1894 the largest canal work undertaken was the construction of Unar Wah on the right bank of the Indus in upper Sindh for irrigation of lands beyond the irrigation scope of Desert canal in the north and Begari canal in the south.

DHAMRAHO, PRICHARD AND OTHER MINOR RIGHT BANK CANALS

The smaller canal project namely Dhamraho and Prichard were also carried out in year 1894. The Dhamraho canal now forms an important branch of

the Rice canal system of Sukkur Barrage. The Prichard canal was converted as an escape and is functioning as such.

Many small irrigation projects some for new canals and others for improving or remodelling the existing ones were undertaken from 1904 to 1919. When the Sukkur Barrage project was sanctioned one of the new canal projects worth mentioning was the Chol branch on the right bank taking off from the approach channel of Begari canal.

In Kashmore area there were two more canals though not as big as Maksuda Wah, Begari or Sindh Wah, which in the British days were named as Jacob Wah and Brigg Wah. These canals were mainly used for filling Sindh Dhoro an old bed of the river Indus, but they provided irrigation supplied to the farmers of the area. South of Sindh Wah there were smaller canals like Sher Wah (now Sherkot branch), Rajab, Ghitti (Gath Wah) and Gurang canals all taking off from the Indus. Garang is the only inundation canal in Sindh operating even after the construction of the three barrages at Guddu, Sukkur and Kotri.

THE MANCHAR LAKE

Manchar Lake has been one of the major sources of irrigation water supplies from times of Mohenjo Daro Civilisation or even earlier i.e., Early Holocene. It was a beautiful lake twenty miles long and ten miles broad during summer season of good precipitation, but in winter it shrunk to an area of about ten miles in diameter. It was quite a deep and vast lake in the fifteenth to eighteenth centuries. The lake provided extensive irrigation in Khabrot, Bubak, Caher, Aktar, Supar, Shah Hasan and Jhangara area. The Western Nara entered the lake at its northern tip whereas Aral canal fed it from the Indus through the southern tip. The flow from Aral was more dependable and larger in quantum than the one from the Western Nara. The lands on the periphery of the lake after evacuation at the end of flood season were cultivated with bumper Rabi crops though in Kharif too people had their canals and Karias (water channels) leading from Manchar to their far-off fields.

Manchar was also supplied water from a number of rain streams coming from Khirthar hills, but this was not regular and reliable source. The Manchar was an important source of food in the form of fish and fowl and hundreds of boats were engaged in catching the fish and trading it in far-off places. In Sukkur Barrage project the lake was provided with an embankment called Manchar Containing Bund 20 miles length from Aral to the outfall or main Nara valley drain. In Manchar-Sehwan-Jamshoro area there were, besides West Nara 37, canals having total length of one-hundred-and-thirty-five miles Phito, Danistar and Karo Sada Bahar being the important feeders tapping the Indus.

LARKANA AREA

The Larkana area on the right bank of Indus then called Chanduka was popularly known as garden of Sindh. It was irrigated by two major canals namely Western Nara and Ghar which originally were the major streams of river Indus, but reduced in size due to siltation. Western Nara the biggest of the canals was quite tortuous in its course and after passing through the present Larkana and Dadu districts joined the Manchar Lake. It was navigable during abkalani or inundation season and the boatmen preferred to move along the Western Nara than the main Indus and there was quite sizeable boat traffic in this channel adding to the trade, business and prosperity of the people. The other major canal was the Ghar which too was as tortuous as the western Nara. In addition to Ghar and Western Nara the third important canal system was named as Wahur Wah, which took off from the Indus about 30 miles south of Larkana and was over thirty miles in length and thirty feet wide at the mouth. It joined back to the Indus near Sita. Marui a branch of Wahur Wah was fifteen miles in length. The above total system comprised of five-hundred-sixty-six miles.

THATTA AREA

It covered the present Right Bank Command of Kotri Barrage or the southern delta region of Indus. It was intercepted by numerous creeks or branches of Indus the major being Juna, Richal, Phitti, Hajamro, Kakariwari, Khedwari and Gharo. The Gharo branch was named after village Gharo situated on its right bank. There were eighteen main feeder canals tapping Indus at different points and thirty one channels big and small which branched off from these canals and provided irrigation supplies.

Of the eighteen feeder canals Baghar, Kalri, Ochto and Sian were very large and were more of byrivers rather than canals from any standard. The Baghar was the western branch diverging a little to the south of Thatta and having numerous branches. It existed even in fourteenth century and was a major stream then and navigable as far as Lahri Bunder the

principal port of Sindh. In 1840 AD this major branch of Indus got silted at its mouth and it ceased to be a perennial channel.

Ochto (Hajamro) was comparatively a small channel. The Sian was the upper part of the Hajamro from its point of junction near Ghorabari. The Hajamro branch of river was an off shoot of Sian or great eastern channel of the Indus. It was connected with the sea and was navigable. It was through this channel that Sir Alexander Burnes and party taking horses for Raja Ranjeet Singh passed on their way to the Punjab. In 1845 Hajamro got reduced in size and was hardly navigable even by small boats. In all there were twenty nine canals which took off from Indus on right bank below Kotri. The total system comprised of three-hundred-and-sixty miles of canals.

INDUS LEFT BANK

It consisted of the present Guddu Left Bank Command. The principal canals that existed on the left bank of Indus in present Sukkur district (Guddu Canal Command) were: Dahar, Imam, Masu, Maharo, Lundi, Bagh Wah, Mian Wah, Dengro, Ganj Bahar, Mahesro, Katri, Janib, Umer Khas, Arore and Mir. In addition to these feeder canals, which tapped the Indus, there were other major branches namely; Sada Kur (twenty-six miles) Ex-Arore, Nihal Wah (eight miles) and Rah Wah (eighty miles) both Ex-Dahar Wah and Kalian Wah Ex-Janib. There were twenty six branch canals Ex-Dengro, fourteen from Lundhi and twelve Korai.

EASTERN NARA CANAL

The first principal canal on the left bank called Eastern Nara was originally the lower part of Drishadvati- Sarsuiti-Hakra system of rivers. Its waters started reducing in 2,000 BC due to aridity and geological fault between it and the Jammuna River kept flowing with low discharges for many centuries. During the "Climatic Optimum" (900-1300 AD) it flowed regularly in summer though during these times most of water came from spills of the Indus and the Sutlej. The eastern branches of the Indus also joined it below Badin from around 900 AD to 1758 AD and spread out in wide sheets of water. The Nara then a river and now a Sukkur Barrage canal possessed and still possesses all the characteristic of a river with a very tortuous course twin and sometimes triple channel flow. It waded its way down to Tharparkar district and ultimately joined Dhoro Puran and then to sea via the Koree Creek.

KHAIRPUR AREA

The Khairpur area was fairly well watered by five canals having their mouths Ex-Indus as well as from the Eastern Nara. The canals were Mir Wah (sixty miles length and sixty feet wide at head), Nara Wah (thirty two miles long and sixty feet wide), Abdul Wah (twenty eight miles long sixty feet wide), Mian Wah (sixteen miles long and thirty feet wide) and Shar Wah. Mir Wah, which was the largest of all, had several cuts which supplied water to the valleys in the sand hills where bajra (millet) and jawar (sorghum) were grown in abundance.

NAWABSHAH DISTRICT AREA

There were in all twenty one feeder canals big and small tapping the Indus at various points. The important ones were Naulakhi (twenty five miles in length forty two feet wide at head), Nasrat (thirty miles long thirty two feet wide) and Dad Wah (thirty three miles long). In all there were seventy four channels big and small about four hundred miles in length: Naulakhi was one of the oldest canals and was probably excavated during the Soomra-Samma period; Nasrat canal got excavated by Nasrat Khan Chandio during the rule of Mian Noor Mohammad Kalhoro, it had its mouth ex-byriver (commonly known as Dhandh) called Gangam; Murad Branch (twenty five miles long); Bagh Wah (twenty seven miles long) and Piroz Wah (twenty four miles long). The three important branches Ex-Naulakhi were excavated by Murad Khan Kalhoro, Bego Sial and Piroz Khan three noblemen of the court of Mian Noor Mohammad Kalhoro.

HYDERABAD DISTRICT

HALA HYDERABAD AREA

This tract was irrigated by a network of canals taking off from four river Ghars namely; Rana, Khanot, Mahmuda and Gahot the supply in Mahmuda being perennial. The canal system comprised of 95 canals big and small having a total length of nearly 1,100 miles.

TANDO MUHAMMAD KHAN AREA

The canal system in this area (excluding Tando

Mohammad Khan and below) comprised of forty three canals about eighty miles in length out of which four were main feeders tapping the Indus. These were; Lakhyar Wah (five miles long Ex-Indus Ghalian), Phuleli Old (thirty five miles long Ex-Indus near Ghalian), Phuleli New (three miles long Ex-Jamshoro) and Chandan Dara (one mile long Ex-Jamshoro).

Tando Muhammad Khan area comprised of nearly one hundred canals large and small. Guni was the largest of all irrigating vast tracts. As may as 53 branch and sub-branch canals extending over a total length of five-hundred-and-sixty-six miles took off from Guni Wah. Another important canal was the Gajah canal which in fact was continuation of old Phuleli. It was forty five miles long and the system comprised of eleven branch and sub-branch canals having a total length of about seventy miles. In addition to Sarfaraz and Phuleli (Old and New) there existed nine more small feeders taking off directly from Indus having a total length of seventy eight miles. Imam Wah (forty miles), Ali Bahar (seven-and-half miles), Pandhi Wah (six miles), Lundo (five miles), Handeehar (six miles), Ghar Sharkart (five miles) and Jhur Wah (four miles) were some of the canals which supplied irrigation water. Ghuri, Gajah and Nasir canals also carried sizeable boat traffic.

SHAH BANDAR AREA

The Shah Bandar tract (south of Tando Mohammad Khan area) much intersected and cut by numerous creeks and channels and its southern area was marshy and unfit for cultivation. The largest of the creeks was the old bed of the Pinyari or Sir River. It ran inland for about sixty miles as far as Moghalbhin (Jati) where a very large embankment stopped it. It was constructed by Talpurs in years 1797 AD. Below this bank Pinyari was navigable to the Sir Creek mouth. During some years of high inundation volume of water in Pinyari increased to the extent that it necessitated some water being let-out to the old and new salt water channels below the bund. In the northern parts (Jati area) it was called Gungro.

Two channels; the Adhiari and Sir were quite broad and deep having a minimum depth of twenty feet. The Mal and Mutri though originally river channels were reduced in size to that of some big canals. They received water during inundation only, but the supply went on declining and in year 1865 AD their mouths had silted to an extent that they received only a little supply. There were in all one-hundred-and-fifty-two canals big and small having total length of eight-hundred-and-four miles. The Pinyari was the largest main feeder with a large number of branch and sub-branch canals taking off from it. The other important feeder canals were; Ali Bahar, Gang Bahar, Mulchand, Bara Gazo, Sahtah, Ghar, Khanot Large, Hasan Ali, Eivet Mal and Mutri. In addition to the ten feeder canals mentioned above, which tapped the Indus, there were thirty more small canals which also took off directly from the Indus. The excavation of watercourses and canals became easier and large scale improvement works were carried out from time to time on the abandoned rivulets to convert them into channels and give them some geometrical shape. Large scale works involving straightening the alignment of these natural rivulets by removing links and curves was not possible. Substantial efforts involving use of human and donkey labour had been put in from time to time to sustain the old channels or to create new ones for meeting the irrigation requirements of the people in different periods.

There were however quite a few small irrigation projects some for new canals and some for improving or remodelling the existing ones undertaken from 1904 to 1919 AD when the Sukkur Barrage project was sanctioned.

By 1904 AD the structure of the Irrigation Department (a wing of Public Works Department) was already functioning efficiently and is given in chart below.

Below is the list of inundation canals as existed in 1904/5 under each syystem of 10 canal districts headed by Executive Engineers. These canals are also shown in irrigation map for 1901.

1. BEGARI CANAL DISTRICT

Canal	Discharge (cusecs)	Cultivation (acres)
Desert canal or Sahi Wah	4,255	190,000
Unar canal or Unar Wah	1,708	214,000
Begari canal	6,745	276,310
Adio Wah	173	-
Nine river canals from various heads	-	2,400

2. SHIKARPUR CANAL DISTRICT

Canal	Discharge (cusecs)	Cultivation (acres)
Sehar Wah	-	5,426
Dahar Wah	-	45,177
Mahi Wah	777	29,356
Masu Wah	531	17,171
Maharo Wah	-	5,463
Lundi Wah	-	2,000
Dengro Wah	-	9,000
Mahesro Wah	-	3,500
Janib Wah	-	800
Mir Wah	-	900
Sindh canal	1,613	91,956

3. GHAR CANAL DISTRICT

Canal	Discharge (cusecs)	Cultivation (acres)
Sukkur canal	-	93,455
Ghar canal system Ford Wah	5,288 3,489	505,649

4. WESTERN NARA DISTRICT

Canal	Discharge (cusecs)	Cultivation (acres)
Western Nara including its	4,565	-
New Feeder and	1,625	-
Prichard canal feeder	1,600	-
Total	7,789	
Aral canal	-	8,136
Danistar canal	-	2,917
Manchar Lake when evacuated	-	20,750

5. KARACHI CANAL DISTRICT

Canal	Discharge (cusecs)	Cultivation (acres)
Baghar	7,400	25,464
Pinyari	4,500	79,168
Kalri	1,000	12,011
Sattah canal	-	9,487
Khanto	-	4,481

6. NORTHERN HYDERABAD CANAL DISTRICT

Canal	Discharge (cusecs)	Cultivation (acres)
Mehrab canal	189	6,817
Naulakhi	1,150	49,786
Dhambro	343	12,420
Dad Wah	2,341	71,457

7. CENTRAL HYDERABAD CANAL DISTRICT

Canal	Discharge (cusecs)	Cultivation (acres)
Minor river canals	-	4,296
Ren Wah	751	2,785
Ali Bahar Kacheri	-	10,291
Markh Canal	1,180	54,887
Gharo Mahmudo	-	64,979
Ghalu Canal	647	35,742
Nasir Wah	-	33,834
Sarfaraz Wah	399	27,344

8. PHULELI CANAL DISTRICT

Canal	Discharge (cusecs)	Cultivation (acres)
Phuleli (perennial) minor river canal	11,000	303,512
Hassanali	489	1,129
Khair Wah		2,096
Dhadhko Wah		1,634
Mulchand canal		
Chhandann		
Mir Wah		
Waseeng Wahy		5,994
Noor Wah		
Khokar Wah		

9. JAMRAO CANAL DISTRICT

Canal	Discharge (cusecs)	Cultivation (acres)
Jamrao Canal with minor canals namely:	-	272,267
Nam Saheb		
Dina		
Patoi		
Dosn Dahraro		
Mirpur		
Bareji		
Puran		
Juriasar		
Duleri		
Bagi		
West Branch		

10. EASTERN NARA CANAL DISTRICT

Canal	Discharge (cusecs)	Cultivation (acres)
Eastern Nara Canal (feeding Jamaro, Mithrao, Nara and other canals)	13,000 in Kharif 2,000 in Rabi	-
Mithrao	2,325 Khrif	150,811
Nara		35,500
Heran		1,925
Khipro		3,523
Thar	1,175	56,532
Hiral		27,551

The above discharge and cultivation figures are for years 1902-3 to 1904-5. The discharges are the average maximum for these years. Since discharges varied from day to day and year to year depending on level of water in the river which in turn varied from year to year the cultivation figures as well as discharges are indicative only that in some years water in the canals flowed late and at other times receded early. There was uncertainty of acreage which would reach maturity for harvest. It caused partial failures of crops at least one in each three years out of five on almost all canals. The poverty it created resulted in low standards, lack of education and superstition. The income to government from land revenue was low and government was not able to spend on education, health and agricultural services. This pitiable condition led to loss of forty percent lives in Sindh in 1917-18, specially due to influenza.

FLOOD PROTECTIVE EMBANKMENTS ALONG THE INDUS

The first experiment on the flood protective embankments was done by John Jacob in Jacobabad district in 1852. His experience made it very clear that earthen embankments constructed some five miles or more from the main channel of the Indus could contend the river within the embankments and annual flooding of vast areas of plains can be averted. The Public Works Department started work on flood Protective embankments in 1860 which was completed in the years as given in table below:

TABLE SHOWING FLOOD PROTECTIVE EMBANKMENTS AND DATES OF THEIR CONSTRUCTION

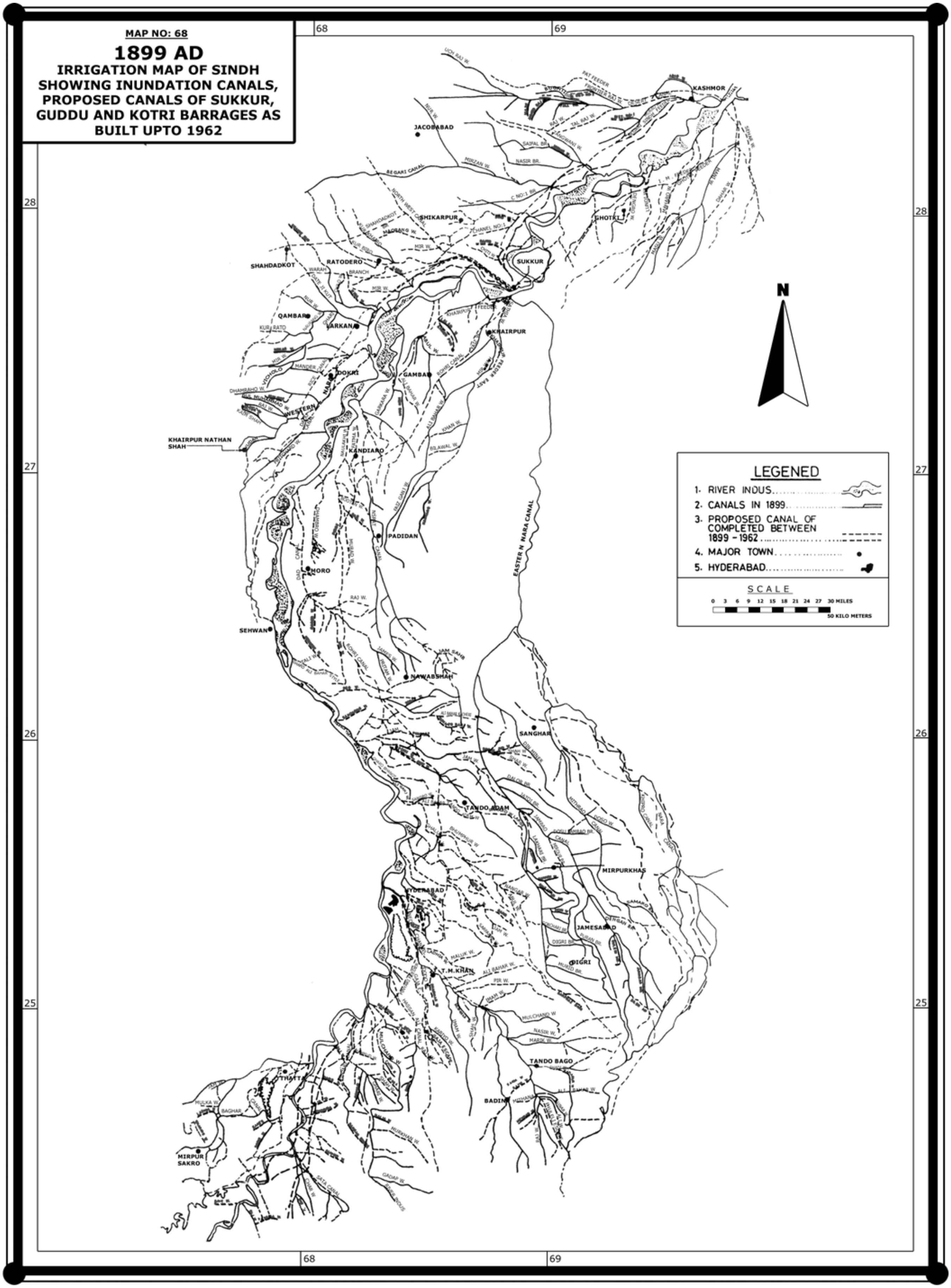
Embankments and irrigation districts	Year of start	Year of completion
1. Begari	1874-75	1879
2. Shikarpur	1869	1890
3. Ghar Canal	1874-57	1890
4. Western Nara embankments namely: Phulu, Gap Band, Nara-Manjhand Band		1890
5. Karachi embankments consisting of:		
Sonda-Hilaya Band		1887
Panah-Baghar Band		1890
Baghar-Ochto Band		1900
Mulchand-Shahbandar Band		1880
6. Northern Hyderabad consisting of: Naulakhi-Dhambro top		1904
7. Central Hyderabad consisting of:		1894-95
Ghalu-Ali Bahar Band	1895	1896
Golyan Band	1892-93	1900-01
Jamshoro Band	1994	1895
Giddu Bander Band	1895	1896
Malh Band	1895	1896
Hajipur Band		
8. Eastern Nara canal consisting of:		
Rata Band	1854	1858
Jaba Band	1873	1893

In 1864 the British government had decided to float loans for irrigation project on the same lines as for railways. Such loans were advanced in Madras for the Madras Irrigation Company and The East India Irrigation Company guaranteeing five percent on capital invested. In case of Sindh such loans were never floated, encouraged or made available. It kept Sindh back-ward for at least fifty years. Table below gives year-wise figures of cultivation in Sindh on inundation canals for about sixty years. The area was doubled in first twenty seven years and further improvement did not take place as there always was a limit to the

MAP NO: 68

1899 AD

IRRIGATION MAP OF SINDH SHOWING INUNDATION CANALS, PROPOSED CANALS OF SUKKUR, GUDDU AND KOTRI BARRAGES AS BUILT UPTO 1962



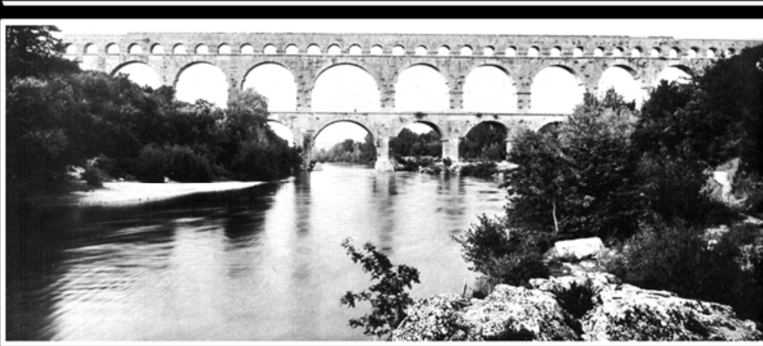
improvement in the inundation canal system. Only barrages on the Indus could increase more area, but for investment on them the Bombay Presidency gave Sindh step-motherly treatment with occasional exceptions like George Lloyd and Leslie Wilson, Reay, John Muir Mahceni Zib and a few others.

TABLE SHOWING INUNDATION CANAL CULTIVATION (IN MILLION ACRES) UNDER THE BRITISH 1874 - 1931 AD

Year	Kharif	Rabi	Total	Jagir	Total
1873-74	1.196	0.223	1.419	Included in Kharif and Rabi figures	1.419
1874-75	1.224	0.373	1.597		1.597
1875-76	1.139	0.251	1.390	0.191	1.581
1876-77	1.291	0.419	1.710	0.136	1.846
1877-78	1.094	0.202	1.296	0.123	1.419
1878-79	1.333	0.552	1.885	0.131	2.016
1879-80	1.115	0.228	1.343	0.111	1.454
1880-81	1.173	0.156	1.329	0.164	1.493
1881-82	1.260	0.159	1.419	0.183	1.602
1882-83	1.282	0.226	1.508	0.165	1.673
1883-84	1.197	0.165	1.362	0.179	1.541
1884-85	1.354	0.232	1.586	0.197	1.783
1885-86	1.289	0.244	1.533	0.207	1.740
1886-87	1.408	0.186	1.594	0.221	1.815
1887-88	1.438	0.215	1.653	0.218	1.871
1888-89	1.649	0.239	1.888	0.231	2.119
1889-90	1.722	0.388	2.110	0.240	2.350
1890-91	1.597	0.385	1.955	0.248	2.203
1891-92	1.514	0.436	1.950	0.216	2.166
1892-93	1.633	0.535	2.168	0.231	2.386
1893-94	1.668	0.472	2.140	0.246	2.386
1894-95	1.621	0.772	2.393	0.243	2.636
1895-96	1.522	0.319	1.841	0.256	2.097
1896-97	1.879	0.365	2.244	0.253	2.497
1897-98	1.995	0.530	2.525	0.281	2.806
1898-99	1.803	0.373	2.176	0.280	2.456
1899-1900	1.945	0.342	2.287	0.282	2.569
1900-01	2.168	0.545	2.713	0.331	3.044
1901-02	1.983	0.526	2.509	0.299	2.808
1902-03	1.939	0.385	2.324	0.302	2.626
1903-04	2.198	0.611	2.809	0.343	3.152
1904-05	2.090	0.524	2.614	0.310	2.924

1905-06	2.380	0.631	3.011	0.337	3.384
1906-07	2.377	0.785	3.162	0.324	3.486
1907-08	2.082	0.434	2.516	0.256	2.772
1908-09	2.361	0.668	3.029	0.316	3.345
1909-10	2.161	0.483	2.644	0.283	2.927
1910-11	2.287	0.545	2.832	0.290	3.122
1911-12	2.102	0.398	2.500	0.233	2.733
1912-13	2.334	0.440	2.774	0.265	3.039
1913-14	2.358	0.512	2.870	0.277	3.147
1914-15	2.302	0.732	3.034	0.315	3.349
1915-16	2.131	0.620	2.751	0.281	3.032
1916-17	2.529	0.586	3.115	0.313	3.428
1917-18	2.188	0.716	2.904	0.256	3.160
1918-19	1.885	0.334	2.219	0.198	2.417
1919-20	2.308	0.588	2.896	0.259	3.155
1920-21	2.221	0.305	2.526	0.237	2.763
1921-22	2.096	0.587	2.683	0.256	2.939
1922-23	2.275	0.656	2.931	0.294	3.225
1923-24	2.253	0.519	2.772	0.292	3.312
1924-25	2.385	0.635	3.020	0.288	3.060
1925-26	2.316	0.399	2.715	0.283	2.998
1926-27	2.302	0.587	2.880	0.268	3.157
1927-28	2.316	0.402	2.718	0.255	2.973
1928-29	2.395	0.507	2.902	0.269	3.171
1929-30	2.560	0.529	3.089	0.273	3.362
1930-31	2.367	0.618	2.985	0.262	3.247
1931-32	2.206	0.596	2.802	0.258	3.060

Note: Influenza of 1917-18 had killed 40% rural population of Sindh. Consequently the area under cultivation in the following year was reduced by 743,000 acres or by 25%.



871. Pont du Gard near Orange. 1st century AD. Roman aqueduct constructoin, consisting of superimposed arches.
compare with Sukkur Barrage (MWK).

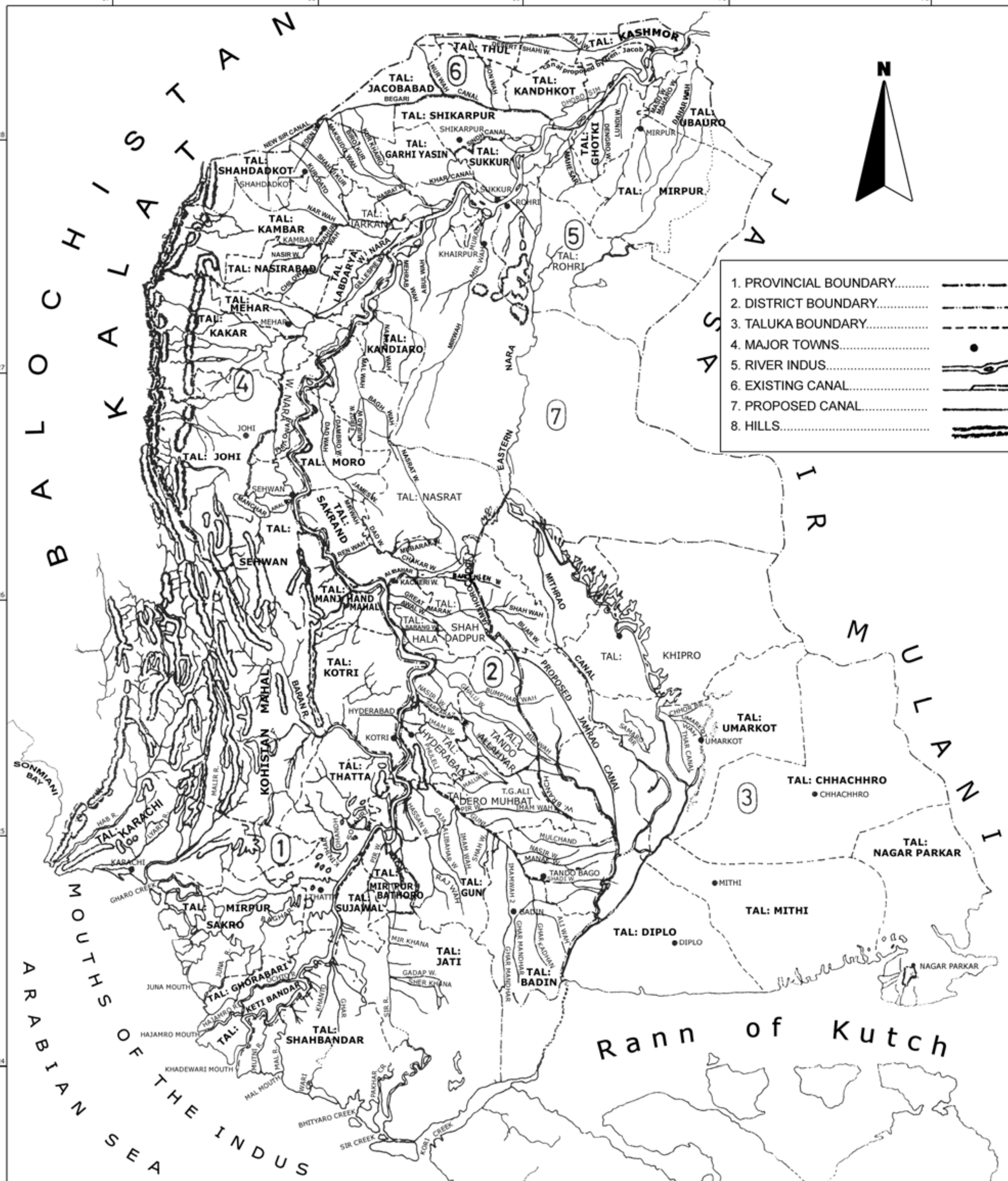
CHAPTER 32

HISTORY OF SUKKUR BARRAGE; 1855 - 1932 AD

HISTORY

History of Sukkur Barrage; controversies on its construction, economics, feasibility and funding over a period of nearly seventy years are so interesting that it has to be given proper place as detailed below:

- In 1847, Lt. Colonel Walter Scott, RE, in his report discussed the possibility of a dam across the Indus at Sukkur to supply irrigation canals, but rejected the idea because he thought that such a dam would surely turn the Indus from its present course.
- In 1855-57, J.G. Fife, RE, the then "Superintendent of the Nara Survey", wrote a report 'A Sketch of Irrigation in Sindh with Proposal for its Improvement'. In this report he suggested construction of five new canals; three of which were to irrigate almost the same area as the present Sukkur Barrage and two more; one each to irrigate left and right banks of the Indus between Jherruck and the Arabian Sea.
- In 1857, The Hon. Court of the East India Company remarked that Fife's scheme was not based on detailed surveys and authorised "a minute survey" of the whole of Sindh.
- In 1858, Fife, then Chief Engineer, proposed a perennial canal on the left bank of Indus to discharge 1426 cusecs in the northern Hyderabad district (present Naushehro and Nawabshah districts) against final design of 10,887 cusecs.
- In 1859, the Commissioner-in-Sindh, Mr. (afterwards Sir) Bartle Frere forwarded to government a report and estimate by Captain J.G. Fife for Rohri-Hyderabad Canal – a portion of Lt. Fife's original proposals. For seven years the matter remained in abeyance.
- In 1866, Colonel Strachey, Inspector General of Irrigation India, visited Sindh and was much impressed with the necessity for perennial canals in Sindh.
- Rohri-Hyderabad Canal was prepared by orders of government, but recommended a smaller scheme capable of extension.
- In 1867, the Government of Bombay accepted the above scheme and informed Fife (then Col. and Chief Engineer) to revise the proposal. Capt. Le Mesurier, R.E., was assigned the job in 1968. Le Mesurier revised the above project for a perennial canal on the left bank to irrigate 815,544 acres. The Bombay Government returned the project asking for the clear understanding with the ruler of Khairpur State, through which the canal was to pass.
- In 1869, after negotiations with Mir Ali Murad, ruler of Khairpur State, a revised project for a canal of 7,045 cusecs at a cost of Rs. 20 millions was sent to the Bombay Government, which passed it on to the Government of India and the Secretary of State for India.
- In 1869, the Secretary of State for India drew the attention of the Government of India to the necessity of improving the irrigation of Sindh.
- In 1871, the Government of India encouraged perennial irrigation in Sindh and even suggested the "Sindh Triple Project", a predecessor of Guddu, Sukkur and Kotri barrages.
- In 1871, The Government of India suggested to the Government of Bombay the preparation of projects for perennial canals for the whole of Sindh – each project to form an integral part of a comprehensive scheme.
- In November 1872, Lord Northbrook, the Viceroy of India, visited Sindh and from the information laid down before him he ordered the project to be abandoned.
- In 1877 and again in 1880, the Secretary of State for India (Lord Salisbury), drew the attention of the Government of Bombay to the unsatisfactory state of irrigation in Sindh and asked for investigation in consultation with the



MAP NO: 69

1901 AD

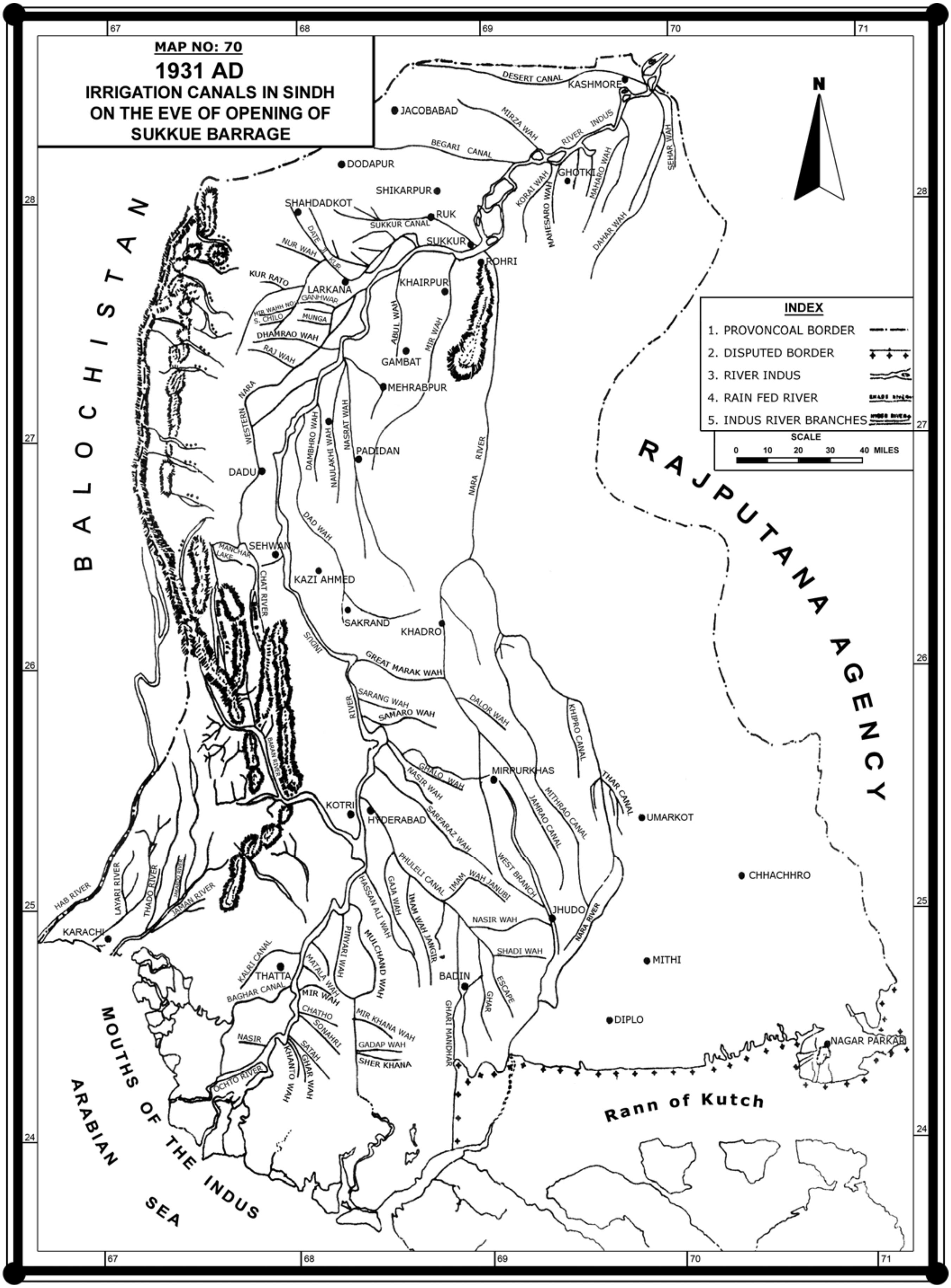
IRRIGATION NETWORK IN SINDH

16 14 12 10 8 6 4 2 0 4 8 12 16 20 14 20 32 MILES

BETWEEN 1873 TO 1901 THE BRITISH ENGINEERS MADE MANY REMODELINGS OF OLD CANALS, MERGING SOME TOGETHER IN ONE CANAL OR GAVE HEAD TO OLD CANALS FROM A LARGE CANAL TAKING OFF DIRECTLY FROM THE INDUS AND PROVIDING A LARGE INLET REGULATOR. THE MOST IMPORTANT DEVEPOLMENT OF THE PERIOD WAS CONVERTING OLD HAKRO-SARSUITI BED INTO PERENNIAL CANAL BY GIVING IT HEAD NORTH OF ROHRI AND CONSTRUCTING JAMRAO, MITHRAO AND NARA CANALS BELOW JAMRAO HEAD.

Government of India. However, the latter after Northbrook's minute became cold towards any extensive irrigation works in Sindh.

- The improvement in the indigenous canal irrigation in Sindh was limited to straightening, widening, deepening and increasing the length of Kalhora-Talpur period canals and also limited improvement of the gradients, which was done up to 1874, as in the Appendix- I the list of early British canals in Sindh shows. Only three new canals; Ford, Briggs and Jacob Wah were added since 1843. The Sindh engineers now had only one long term alternative to improve existing canals by giving them new heads in the riverine areas and by merging and making many small canals as branches of larger canals. The process was to continue up to 1931. The irrigation maps of 1873, 1899, 1910 and 1931 show these major changes for canal improvement. The canals thus became government owned rather than privately owned, operated and maintained. The Sindh canals remained mostly non-perennial supplying water for about ninety to one-hundred-and-twenty days in the majority of cases and in some unsuitable areas only for one day. The damage was incalculable. In other parts of the South Asia, specially Uttar Pradesh and the Punjab, perennial irrigation led to development of horticulture i.e., evergreen and deciduous fruits, nuts and industrial crops, winter vegetables and floriculture. Sindh's soil produced mostly rice and followed by a second crop in some suitable areas on preserved moisture. This in turn was limited mostly to peas and oil seeds and occasionally to horse beans and wheat. The low level of this development caused poverty, child labour and lack of revenue.
- Lack of spending on schools and health facilitates resulted in high death rate and low intelligence. Rice cultivation also caused water-logging, salinity and deterioration of land in Sindh compared to other areas in Indo-Gangetic plains.
- In 1880, the Secretary of State for India sharply reminded the Government of Bombay of the unsatisfactory state of irrigation in Sindh and requested that the matter be reconsidered in consultation with the Government of India.
- In 1881, the Bombay Government reported that very large perennial canals could be constructed on both banks of the Indus, but recommended only a small Rohri-Hyderabad Canal and Dhamraho canal of about the same size.
- In 1882, the Government of India concurred the scheme and in May 1882 informed the Secretary of State accordingly. The matter then remained in abundance for eight years.
- In 1890, Lord Reay, the Governor of Bombay, challenged the wisdom of carrying out inundation irrigation in Sindh, specially as it was being carried out at enormous cost on labour for desilting and lifting water on the field by Persian wheels. He ordered appointment of a committee to enquire into improvement of canal irrigation in Sindh. R.B. Joyner, C.I.E, the then Executive Engineer Hyderabad, was to enquire into the practicability of a Rohri-Hyderabad canal.
- In 1890, Fife (then a retired general) wrote a letter to the Secretary Government of Bombay pressing for his 1855 proposal for perennial canals in Sindh.
- In 1891, Joyner reported on perennial canal on the left bank from Rohri commanding 4,000 square miles (2.56 million acres) of land. Incidentally Rohri canal was constructed in 1932 to command 2.7 millions acres of land.
- In 1891, surpassingly Charles B. Prichard, once Commissioner-in-Sindh, after whom the Prichard (link) canal was built to supply water to southern reaches of the western Nara canal and Chairman of Commission appointed by Lord Reay also became party to the rejection of Joyners report as financially unsound.
- Tando-Phuleli Zamindars and Jagirdars Association had already written many memoranda against the Viceroy Northbrook's directives of 1872. They also protested against Prichard Committee's findings.
- This fate of Rohri-Hyderabad canal left only one choice for Sindh i.e., improvement of inundation canals. These improvements between 1891-1904 are statistically discussed in the last chapter and shown in canal maps of 1901 and 1910.
- In 1892, the Commissioner-in-Sindh, Sir Evans James, presided over the Committee on which Mr. Joyner was the Public Works expert and the whole Committee reported that the proposed Rohri-Hyderabad was not needed and was unsound financially. They recommended the final abandonment of this proposed perennial system and instead the construction of an eastern and western canal for eastern Sindh to be fed from a deepened Nara Valley Supply channel taking off the Indus at Rohri opposite Sukkur.


MAP NO: 70
1931 AD
IRRIGATION CANALS IN SINDH
ON THE EVE OF OPENING OF
SUKKUE BARRAGE
INDEX
1. PROVONCOAL BORDER
2. DISPUTED BORDER
3. RIVER INDUS
4. RAIN FED RIVER
5. INDUS RIVER BRANCHES
SCALE
0 10 20 30 40 MILES
N
BALOCHISTAN
RAJPUTANA AGENCY
Rann of Kutch
MOUTHS OF THE INDUS
ARABIAN SEA
JACOBABAD
KASHMORE
DESERT CANAL
MIRZA WAH
BEGARI CANAL
RIVER INDUS
DODAPUR
SHIKARPUR
SHAHDADKOT
RUK
SUKKUR CANAL
SUKKUR
ROHRI
GHOTKI
KORAI WAH
MAHESARO WAH
MAHARO WAH
DAHAR WAH
SEHAR WAH
NUR WAH
KUR RATO
LARKANA
GANHWAR
MUNGA
DHAMRAO WAH
RAJ WAH
KHAIRPUR
ABUL WAH
MIR WAH
GAMBAT
MEHRABPUR
WESTERN NARA
DAMBHRO WAH
NAULAKHI WAH
NASRAT WAH
PADIDAN
NARA RIVER
DADU
DAD WAH
SEHWAN
MANCHAR LAKE
CHAT RIVER
KAZI AHMED
SAKRAND
KHADRO
SINDH RIVER
GREAT MARAK WAH
SARANG WAH
SAMARO WAH
DALOR WAH
KHIPRO CANAL
THAR CANAL
GHALO WAH
NASIR WAH
MIRPURKHAS
SARFARAZ WAH
JAMRAO CANAL
MITHRAO CANAL
UMARKOT
KOTRI
HYDERABAD
BARAN RIVER
PHULELI CANAL
IMAM WAH JANUBI
WEST BRANCH
CHHACHHRO
HAB RIVER
LAYARI RIVER
THADO RIVER
JAMAN RIVER
KARACHI
HASSAN ALI WAH
GAJA WAH
IMAM WAH JANGIR
JHUDO
NARA RIVER
NASIR WAH
PINYARI WAH
MULCHAND WAH
SHADI WAH
MITHI
KALRI CANAL
THATTA
MATALA WAH
BAGHAR CANAL
MIR WAH
BADIN
ESCAPE
GHAR
GHARI MANDHAR
CHATHO
SONAHRI
MIR KHANA WAH
GADAP WAH
SHER KHANA
DIPLO
NAGAR PARKAR
NASIR
SATAH
KHANTO WAH
GHAR WAH
OCHTO RIVER
67
68
69
70
71
28
27
26
25
24

- In 1893, sincere to his 1855 project, General Fife wrote to the Secretary of State pressing for implementation of the project and need for a separate Chief Engineer for Irrigation in Sindh to advice the government as well as guide the Superintending Engineers (to be added) for a systematic management of a regular policy.
- In 1893, the Government of Bombay accepted the recommendations of the Joyner Committee and issued orders for the preparation of the Eastern Nara Improvements and Jamrao Canal projects. The Rohri-Hyderabad Canal Project was abandoned, but the Government of Bombay was not prepared to abandon entirely the principle of high level perennial canals for Sindh.
- In March 1894, Mr. Thompson, then the Superintending Engineer in Sindh rejected Fife's opinion and thus creating further problems for improvement of irrigation in Sindh.
- In 1903, Indian Irrigation Commission, which referred to Sindh Triple Project, opined that the vast scheme of this type appears to be feasible, but there are practical considerations which would perhaps render it desirable to reduce its scope. Sindh was represented by Chief Secretary of Bombay Mr. John P. Muir- Mackenzie, who brilliantly pressed for the weir on the Indus and his performance led to his appointment as Commissioner-in-Sindh in 1904.
- The Indus Irrigation Commission set up by Lord Cruzan in 1901-1903 took two important decisions. Diversion from the river Indus was not allowed without assent of Sindh. The Commission also laid down the policy that irrigation projects concerning more than one province had to be referred to Governor General of India for his decision.
- In 1904, Dr. Summers, Superintending Engineer in Sindh sought permission of the Government to take a canal from Rohri across the Khairpur State to feed Dad canal and pointed out that continuous increase of irrigation in the Punjab made is essential to construct barrages in Sindh, but it was James Evens, retired Commissioner-in-Sindh, who in 1899 left a minute that 'the Punjab will eventually force a weir upon us'.
- In 1905, Dr. Summers obtained permission to extend his survey of canal beyond Dad canal across the central Hyderabad canals to the lift lands of Phuleli canal and end in Dhoro Puran below Jamrao tract.
- In 1906, J. Benton, Inspector General of Irrigation Government of India, visited Sindh to enquire into possibility of perennial canals in Sindh and suggested what investigation should be made for a weir and canals with an off-take at Rohri.
- In the same year (1906) the Government of India suggested to the Government of Bombay that increasing cold weather withdrawls in the Punjab would diminish supplies in the inundation canals in Sindh and suggested that eventually requirement of canal waters in Sindh can be met from:

  - Mithan Kot (predecessor of Guddu)
  - Sukkur
  - Kotri or Jherruck
  - Sehwan

For the present only second system need to be considered. The foresight in this suggestion was a weir at Sehwan un-determined by Fife and his successors and not again discussed seriously until Ayub's Commission on Agriculture in 1959 and the LIP report of 1965 which pressed for its execution.

- In 1909, feeling doubtful whether at the assessments proposed projects with a barrage would prove to be a "productive work" (as required by the P.W.D. Code), Dr. Summers prepared an alternative scheme without any barrage. Mr. H.F. Beale submitted his report and estimates for the Sukkur Barrage and for the headworks of all the great canals. Mr. B.E. Vacha submitted his report and estimates for the Eastern Nara Improvements Scheme.
- 1903-1920 were the years of great development in construction and earth moving machinery. In 1903 Ford had already developed Mode-T car, which remained unsurpassed for 25 years. Caterpillar had developed crawler tractors and Le-Tournea developed scrapper bulldozer blade and power winch to operate them. Ruston of England developing stationary and portable diesel engines jointly with Bucyrus was to develop draglines, clam-shafts, cranes, drilling and blasting rigs and pile hammers. Mulit-cylinder petrol engines were already operating compressors. Multi-cylinder diesel engines too were developed. For higher power requirements multi-cylinder light steam engines with portable boilers became available. These new tools not

only lowered the construction costs, but cut down on labour for earth moving, which was difficult to get in Sindh and the donkey labour would have taken many years to accomplish task of excavation of the canals and constructing the weir (barrage) at Sukkur-Rohri site.

- In 1910, working on Triple Canal Project, Dr. Summers showed that the Triple Canal Project would give a return of 4.24% exclusive of interest on capital outlay during construction and was unremunerative. But he was convinced that it could be made more remunerative by constructing Rohri canal first which will remain inundation canal until weir is constructed. This way there will be saving of Rs. 1.5 to 2.0 millions per annum on the interest. In September 1910 he sent a revised proposal with the following estimates:

Rohri canal	Rs. 4,412,861
Barrage or weir	Rs. 3,000,000
Widening of Nara canal	Rs. 400,000
Total	**Rs. 7,812,861**

The attitude of Thompson and Summers not to expand the irrigation administrative organisation vertically and horizontally beyond the level of one Superintending Engineer for the whole Sindh was responsible for maximum harm to Sindh.

- In 1912, the Government of India submitted the whole scheme to the Secretary of State for India who appointed a committee of experts to report on it. The committee consisted of Colonel Sir J. Ottley, Messrs Lionel Jacob, W.L. Cameron and A.L. Webb.
- In 1912-13, Secretary of State for India appointed a committee to examine Dr. Summers report. The report came out in December 1913 which stated that:
  - a) Project was not a protective measure, but was not productive either as the period of execution was very long (up to sixteen years).
  - b) It was premature.
  - c) The scheme should be prepared and kept in readiness as Sindh may suffer due to more withdrawls of water in the Punjab in future.
  - d) Site for Barrage on upstream side of Rohri did not appear to be suitable.
- In 1913, the British had difficulty at home in getting raw cotton for their own textile industry. Japan and USA had developed their own textile industries and the British were faced with difficulty of getting cotton. The British now felt that vast uncultivated areas in Sindh could be profitably utilised for raising cotton as dry climate of Sindh combined with adequate heat days was most suitable area in the South Asia for raising cotton. Hereafter quick decisions for executing Sukkur Barrage were motivated to serve the British interests.
- The British related development in Sindh, primarily, was to connect Karachi with Delhi and Lahore to take surplus grains from the Punjab abroad easily, economically and expeditiously, and the policy of no further urgency to develop irrigation in Sindh changed overnight due to demand for cotton in England.
- Lack of development of irrigation in Sindh resulted in lack of agriculture surplus and therefore under development of urban centres in Sindh. In 1884-85 there were only six towns in Sindh having population of more than 10,000 persons, but none of them had more than 100,000 souls. In 1901 Karachi had a population of 120,000.
- In 1914, in consequence of the 1913 Report the Secretary of State declined to sanction the Bombay Government’s scheme, but drew attention to the desirability of further investigations.
- In 1915, the Karachi Chamber of Commerce strongly protested against any further delay. The Bombay Government declined to accept the London Committee’s opinion that the 1913 scheme was premature. In regard to Sindh as an inundation country not worthy of perennial water supplies would be to adopt a policy of stagnation to which the Government of Bombay declined to subscribe. They proposed to prepare new plans.
- In 1915, Mr. A.A Musto was put on special duty under Chief Engineer in Sindh to revise the project named as Sukkur Barrage Project.
- In 1917, Inspector General on Irrigation Sir Thomas Ward visited Sukkur and a conference was held there with the Chief Engineer Sindh and the Chief Engineer Bombay. Subsequently meeting was held with the Commissioner-in-Sindh at Karachi. The Inspector General, guided by his predecessor Maechel Nethersole’s minute,

made the following important suggestions:

a) Involvement of Revenue (Revenue, Survey and Settlement) Department as well as Canal officers (Executive Engineers).
b) Ship's lock may be dropped (This was a mistake as time has proved).
c) Canals may be kept small for economic use of water (This too was a mistake and intensity of cropping remained low in Sindh).
d) Remodelling inundation canals to fit in new canals of the Barrage by methods as adopted in the Punjab.
e) Rohri canal should be constructed as inundation canal first and then merged in Sukkur Barrage system as remodelling after the construction of Barrage may be costly.
f) Discharge of Rohri canal should be reduced from 15,500 to 10,000 cusecs (It was designed for 9,600 cusecs and today it carries 16,000 cusecs. The reduction of discharge too was a serious mistake).
g) Revenue, Agriculture and Irrigation officers should work out a payable scheme and demonstration farms may be established.

- In 1918, Mr. Musto was recalled from Mesopotamia to take up the work of visiting the whole scheme. By coordinating the work (which hitherto had been under four engineers working almost independently – Right Bank Canals, the Eastern Nara Canals, the Rohri-Hyderabad Canals and the Sukkur Barrage) many improvements and economics were effected. On the 16th December the new Governor of Bombay, Sir George Lloyd, G.C.I.E., D.S.O., arrived in Bombay.
- In 1919, Sir George Lloyd visited Sindh first time. All public bodies represented to His Excellency their keen desire to see a far greater use made of the magnificent river Indus than that of serving Sindh's old fashioned out-of-date inundation canal system. Sir George Lloyd promised immediate attention to the matter.
- In 1920, during Sir George Lloyd's second visit to Sindh he stated that all departments were working at the revised Sukkur Barrage Project with the utmost zeal and at the highest pressure. The revised scheme was completed in this year.
- In 1921, Sir George Lloyd's third visit to Sindh reflected his close interest in the project. Mr. Musto's Revised Sukkur Barrage Scheme in twenty volumes despatched via the Government of Bombay and of India to the Secretary of State for India. On 25th July Dr. Summers addressed the East India Association, London, strongly condemning the 1920 Revised Project as financially unsound and from an engineering point of view both unsound and dangerous.
- Plans and estimates for barrage and canals prepared in 1919 and 1920 respectively were sent by Government of Bombay to Government of India and passed on to Secretary of State for India who gave the approval in April 1923 and construction started on 1st July 1923. The barrage was completed in December 1931 and opening ceremony performed by Earl of Wilmington, Viceroy and Governor General of India on January 13, 1932.
- The Government documents in general are silent about the role of public opinion and protests on the question of Sukkur Barrage. Role of Tando-Phuleli Zamindars and Jagirdars has already been mentioned since 1872. But role of another two workers; Ghulam Muhammad Bhurgari and Seth Harchandrai is commendable. The former pursued the Sukkur Barrage Project in Sindh Provincial Conference year-after-year and accompanied by the latter met with Edwin Montagu, Secretary of State for India in 1918 to pursue the project, which could any time be dropped for want of funds. As a result of persuasion by Ghulam Muhammad Bhurgari, Harchandrai and Lawrence, the Commissioner-in-Sindh, E.M. Montagu, Secretary of State sanctioned the project and in ensuing eighteen months settled the question of funding the project by loan from Government of India. He gave final approval to the project in April 1923.
- Construction of barrage started on 1st July 1923. During the construction Governor of Bombay George Lloyd too played major role.
- In 1923, the Sukkur Municipality unanimously passed a resolution that the Sukkur Barrage may be named as the Lloyd Barrage after George Lloyd Governor of Bombay. (Fifty years later this name was changed.)
- In July 1923, the Government of Bombay issued orders that in view of recommendations of the municipality barrage may be called George Lloyd Barrage (not Lloyd George, Prime Minister of England) after the then Governor of Bombay. Lloyd had given his full support for its financing and execution.

SPECIALIZED CONSTRUCTION TECHNIQUES

Once Sukkur Barrage scheme was approved in 1916 the engineers had to give thought to construction methods and techniques to take up a gigantic project of which magnitude had never been executed in the world before. It was known that labour for construction of the barrage would be a few hundred thousand men for some years, which number shall not only be difficult to get, but will raise the labour rates. The 1917 AD influenza had killed forty percent rural population of the Sindh and withdrawing labour from Sindh would have adversely affected the agricultural operations. It was therefore decided to employ machines some of which were specially designed and built for the purpose. They performed following types of operations:

- Interlocking sheet pile hammers for coffer dams and pile sheets.
- Dredgers for depositing sand inside the steel pipes and also excavating the foundations inside coffer dams.
- Dewatering by pontoon mounted with electrically operated centrifugal and reciprocating pumps as well as well-points.
- Forty two miles of railway lines at the barrage-head construction site along with locomotives and truck (wagon) mounted cranes.
- Pontoon mounted cranes.
- Electric supply from an independent power house for the construction.
- Forty six excavators of various sizes for excavating canals. These worked round the clock for five-and-half days a week and two-hundred-and-fifty days a year excavating about 10.4 million cubic feet earth per day – equivalent to 32,000 men working all the year around or 77,000 men for five months of the working season (winter months only).
- Workshop for maintaining and servicing the machines.
- The machines were able to excavate about 5.7 billion cubic feet earth for canals at rates much lower than labour rates prevailing then.
- The cost of machinery employed, including operating costs, formed about 22.6 percent of overall cost of the barrage.

Five other major technological improvements were also introduced along with sanctioning the Sukkur Barrage project. These were:

a) RECTANGULATION OF LAND

The Survey of India had rectangulated farming land down to 320 acre rectangles. The Revenue Officer, Sukkur Barrage, further rectangulated land down to the one acre plot. Standard size of an acre was fixed as north to south 264 feet and east to west 165 feet. This made it easy to level land and gave better control of water into each plot. The watercourses could thereafter be laid economically along the borders of plot. A further benefit to the farmer was assessment of land and water rates to one acre instead of larger plots. Rectangulation helped in orientation of orchards in the most advantageous solar light direction of north to south.

b) SOIL SURVEY

Government surveyed the soils and classified them as classes ‘A’, ‘B’ and ‘C’ denoting good, fairly good and poor quality land fit for rice only after washing the salts. ‘D’ class land was unfit for cultivation except at high reclamation cost. Facilities of extra water for reclamation were provided for ‘C’ class land.

c) AGRICULTURAL RESEARCH

Agriculture Research Station was established at Sakrand in 1924 AD for research into new crops and cropping patterns. This finally led to the establishment of Agricultural College (then known as King George-V Agriculture College) at Sakrand in 1939 – a predecessor of the Sindh Agricultural University Tando Jam. The already existing Fruit Farm at Mirpurkhas was strengthened to encourage perennial fruit crops like mango, citrus, guava, banana, dates, winter vegetables etc. Rice Research Station was established at Dokri. A number of small research stations were established near Thatta, Dadu, Larkana, Shikarpur etc.

d) WATERLOGGING AND SALINITY MEASUREMENTS

More than 3,000 piezometers were installed in the irrigated areas to monitor water table.

e) AGRICULTURE ENGINEERING

This section was established in 1934 for levelling land, breaking of hard and weedy soils and

produce improved agriculture implements for agriculture mechanization as was aimed at. The first workshop was established in 1934 at Mirpurkhas and was shifted to Hyderabad in 1942. The first Agriculture Engineer in Sindh was Mr. Cumming. This workshop was shifted to Tando Jam in 1957. By 1968 Sindh had 13 workshops in different districts with fleet of 600 bulldozers for land levelling and sixty five hand and fourteen power rigs for installing tube-wells.

PROSPERITY BROUGHT BY THE SUKKUR AND OTHER BARRAGES

The Sukkur Barrage bought prosperity to Sindh by assured summer and winter water. The situation before the barrage is best described by Fife in 1859. He stated that during first inundation season he was in Sindh; there was too little water, during the second there had been too much, during the third inundation had risen too late in the season, during the forth it had subsided too early and during the fifth there was too much water. Thus he analysed that there was always some thing wrong as there was always too much or too little water or river rose too late or fell too early. The prosperity that Sukkur and other barrages provided could be seen from the six-fold increase in population over 50 years and 350% increase in cultivated area with several government colleges and six medical universities etc. The agricultural surplus produced has increased urban population to more than 35% of whole population. One of the major economic impacts of the project was that during the first years of the British rule people were extremely poor as correctly analysed by Fife. The Sukkur Barrage changed the situation and within a year of its start rural people of Sindh rushed to cities for education as well as better housing and facilities of urban cities.

TABLE SHOWING SALIENT FEATURES OF SUKKUR BARRAGE

Total latest revised estimated cost of the whole scheme (1935)	£ 15,000,0000 Rs. 200,330,000
Total estimated cost of barrage and head-works	£ 4,300,000 Rs. 55,897,000
Total length of canals of all size excavated	6,473 miles
Total quantity of earthwork to be excavated in the scheme for canals, branches, distributaries and minors	5, 690 millions cu. ft.
Total length of new and old watercourses (30,000 + 17, 800 miles)	47, 800 miles
Total cost of 46 dragline machines employed for excavation work	£ 800,000 Rs. 10,666,000
Total cost all machinery employed inclusive of draglines	£ 400,000 Rs. 45,333,000
Total quantity of earthworks; canals + watercourses 6,280+1,240 m cu. ft.)	7,520 millions cu.ft.
Total number of bridges and regulators to be constructed	1,970
Maximum labour employed any time	60,000 persons
Gross area commanded by the scheme (in British Territory)	7.4 millions acres
Annual cultivation when area is fully developed (in British Territory)	5.01 millions acres
New area of virgin soil brought under command	1.95 million acres
The barrage across the River Indus has 66 spans of 60' each with 2 extra land spans to the "gate" Bridge Cill level of Barrage. Full Supply Level R.L. of springing of gate bridge arches. The "gate" bridge is for manipulating the gates in the openings of the barrage and the "road" bridge is for traffic	R.L. 177.0 feet R.L. 194.5 feet R.L. 219.0 feet R.L. 201.0. feet
Work commenced in (a) All work expected to be finally completed and accounts closed in (b) Canals to flow in	July 1923 1934-35 1932

Government land that would come under command. A Class Land B Class Land C Class Land	 1,058,928 acres 602,205 acres 289,400 acres
Gross Command Area Cultivation command Area A Class denotes. B Class denotes C Class denotes	8.3 million acres 7.8 millions acres Good quality land Fairly good quality land Poor land fit for rice and then only after washing.

Note:- A mile of Irrigation Department is 5000 feet and not 5280 feet.
A foot (30.8 cms) of Irrigation Department has 10 inches (3.08 cms=1.0 inch) and not 12 inches.
In this book miles and feet have been used against metric system

TABLE SHOWING SOME IMPORTANT DESIGN DATA OF SUKKUR BARRAGE AND ITS CANALS

Items	Units	North Western Canal	Rice Canal	Dadu Canal	Eastern Nara	Rohri Canal	Khairpur Feeder East	Khairpur Feeder West
Area under command	Acres	1,027,085	547,480	597,464	2,142,000	2,837,000	531,110	409,121
Cultivated area	Acres	933,093	480,979	498,682	2,069,200	2,546,000	335,500	315,016
Final area under annual cultivation	Acres	761,067	423,802	425,163	1,676,000	2,063,400	261,284	227,131
Maximum discharge	Cusecs	5,042	10,215	2,837	13,602	10,887	2,094	1,940
Length of the main canals	Miles	36.1	81.7	131.6	216.8	270.70	13.0	44.80
Length of distributaries and minors	Miles	700.8	215.0	406.0	1,188.4	1,887.7	-	-
Length of escapes	Miles	-	-	25.22	9.70	31.20	-	-
Length of watercourses	Miles	8,367	6,500	2,919	9,734	20,253	-	-
Spans 25 feet each in the head regulator	Nos.	6	13	4	16	12	2	2

* The maximum discharge of Thames at London is 15,000 cusecs whereas actual maximum discharge drawn in Rohri at present is 16,385 cusecs.
* Width of Suez Canal at surface is 200 ft. and that of Eastern Nara is 370 ft.
* The watercourses in the project area will stretch twice around the world and are about 50,000 miles long.

TABLE SHOWING ACTUAL CANAL DISCHARGE AS COMPARED WITH DESIGNED CAPACITY OF 7 CANAL OF SUKKUR BARRAGE

Name of canal	Design capacity	Actual discharge at peak demand
North Western	5,042	9,500
Rice	10,215	13,770
Dadu	2,837	5,738
Nara	13,602	14,452
Rohri	10,887	16,385
Khairpur East	2,094	2,648
Khairpur West	1,940	3,440

TABLE SHOWING THE YEAR WISE CULTIVATION FIGURES ON SUKKUR BARRAGE SINCE ITS INCEPTION TO OPENING OF OTHER BARRAGES

Year	Cultivation in million acres	Year	Cultivation in million acres
1932-33	2.428	1956-57	4.744
1933-34	2.783	1957-58	4.797
1934-35	2.728	1958-59	5.182
1935-36	2.887	1959-60	5.271
1936-37	2.985	1960-61	5.264
1937-38	3.208	1961-62	5.460
1938-39	3.206	1962-63	5.627
1939-40	3.365	1963-64	5.741
1940-41	3.485	1964-65	5.644
1941-42	3.425	1965-66	6.000
1942-43	3.224	1966-67	6.052
1943-44	3.413	1967-68	6.251
1944-45	3.282	1968-69	6.368
1945-46	3.523	1969-70	6.351
1946-47	3.684	1970-71	6.249
1947-48	4.093	1971-72	5.838
1948-49	3.859	1972-73	6.021
1949-50	3.936	1973-74	6.214
1950-51	4.130	1974-75	6.219
1951-52	4.361	1975-76	6.395
1952-53	4.451	1976-77	6.572
1953-54	4.650	1977-78	6.675
1954-55	4.762	1978-79	7.041
1955-56	4.866	1979-80	7.285

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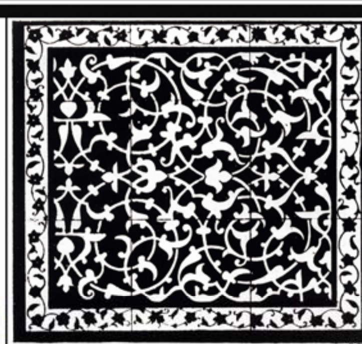

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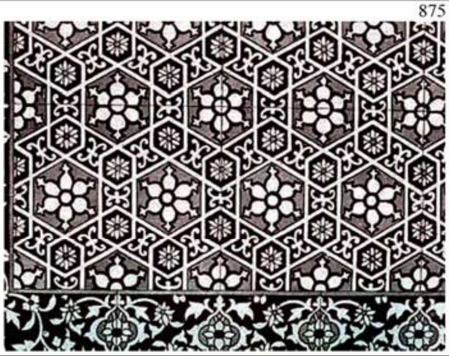

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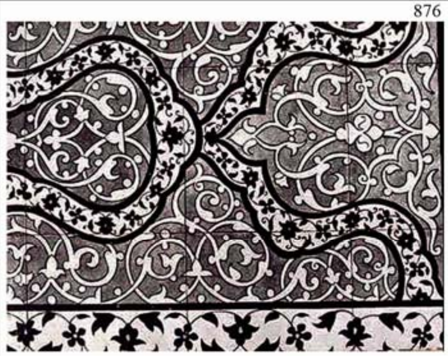

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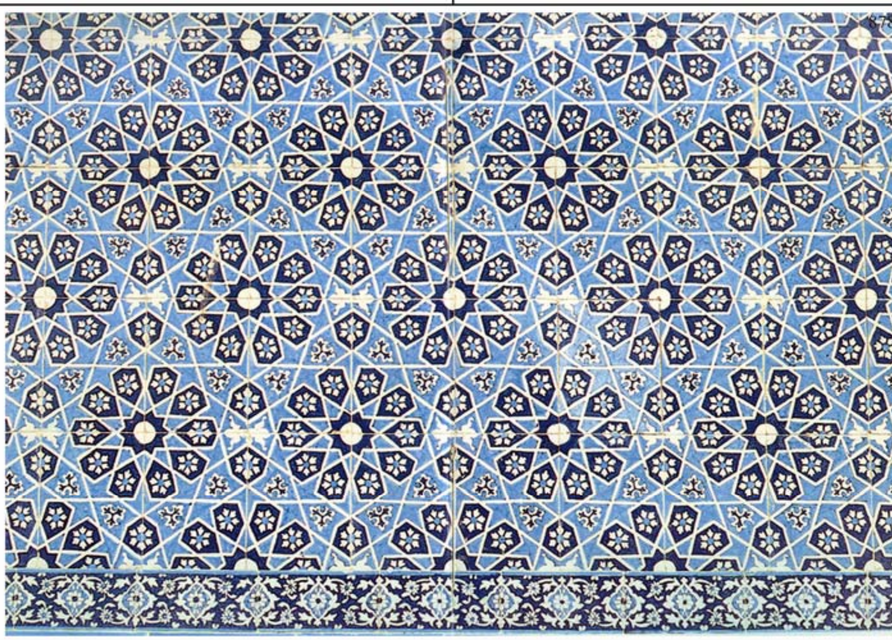

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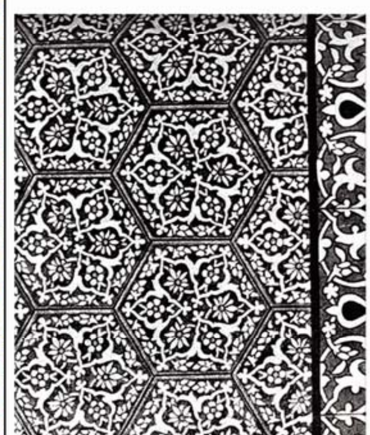

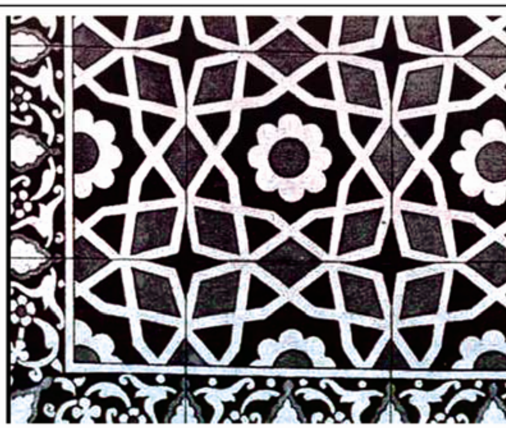

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LOONGI, AJRAK AND TILES DESIGNS

872. Loongi type piece or male head-wear from Gujarat. (Smithsonian).
873. Ajrak like print of twelfth century reported from Gujarat. Communication between Sindh and Gujarat before drying up of Rann of Kutch had made possible similar type of designs on textiles in Sindh and Gujarat. (Smithsonian).
874. Mosque Shah Jehan Thatta, glazed tile.
875. Jami Masjid Thatta, coloured tile dado, 1643 AD.
876. Jami Masjid Thatta, coloured tile dado, 1643 AD.
877. Jami Masjid Thatta, glazed tiles, 1643 AD.
878. Tile decoration, Mosque Shah Jehan Thatta.
879. Tomb of Jani Beg Turkhan Makli, Ggazed tiles, 1600 AD.
880. Jami Masjid Thatta, enameled tile panels with floral and geometric patterns, 1643 AD.

CHAPTER 33

KOTRI BARRAGE PROJECT: 1948 - 1960 AD

As mentioned earlier the supply in inundation canals in upper and lower Sindh kept on decreasing and the need for building two barrages at Guddu and Kotri was more than established. The government of Sindh opened a project circle under able guidance of Mr. Champekar, a Superintending Engineer, who in August 1946 submitted the two projects namely; the Guddu Barrage and the Kotri Barrage canals projects. The lower Sindh inundation canals being situated at the tail end of Indus Basin were getting water only for 60 to 90 days in different years so the Kotri Barrage was given the priority and Government of Sindh accorded administrative approval to the project in September 1946. Two sites for the location of the barrage were considered one at Jherruck and the other at Jamshoro, but latter was finally adopted in the project. The barrage proposed in the project was a double barrage with an island 200-ft. wide in between. The proposal was based on the model experiments carried out at Poona on the best alternative for silt exclusion from canals.

However, the following changes were ultimately made at the suggestion of Sir. T.A.W Foy, who headed it as Chief Engineer cum Secretary Irrigation for the project:

- Single barrage instead of a double barrage.
- Gravity section floor against RCC raft floor.
- Siting barrage 1500 ft. north of original line.
- Siting barrage on the right bank of river with right abutment practically at the existing edge of the river.
- Ring bund method of construction against coffer dam method.

The work was started in 1947 and barrage headworks were completed in 1955. Keenjhar Lake was filled and Kalri-Baghar canal was opened in 1957. From 1960 onwards land was allotted to various categories of people; army, navy, air force, displaced persons from Mangla and various districts of the West Pakistan and Bengalis of East Pakistan. Land levelling and settlement continued. Kotri was first barrage in Sindh to have surface drainage system – an example which helped in designing and executing Left and Right Bank Out-fall Drains.

KOTRI BARRAGE CANALS

There are four feeder canals, which originate from this barrage. Their details are given in table below:

Name of feeders	Design discharge in cusecs	Length in miles	Command area in acres
Lined Channel (Akram Wah)	3,713	76.2	487,347
New Phuleli	15,026	59.8	929,358
Old Phuleli	13,636	56.48	786,353
K.B. Feeder	100	58.38	637,041

THE SALIENT FEATURES OF KOTRI BARRAGE PROJECT

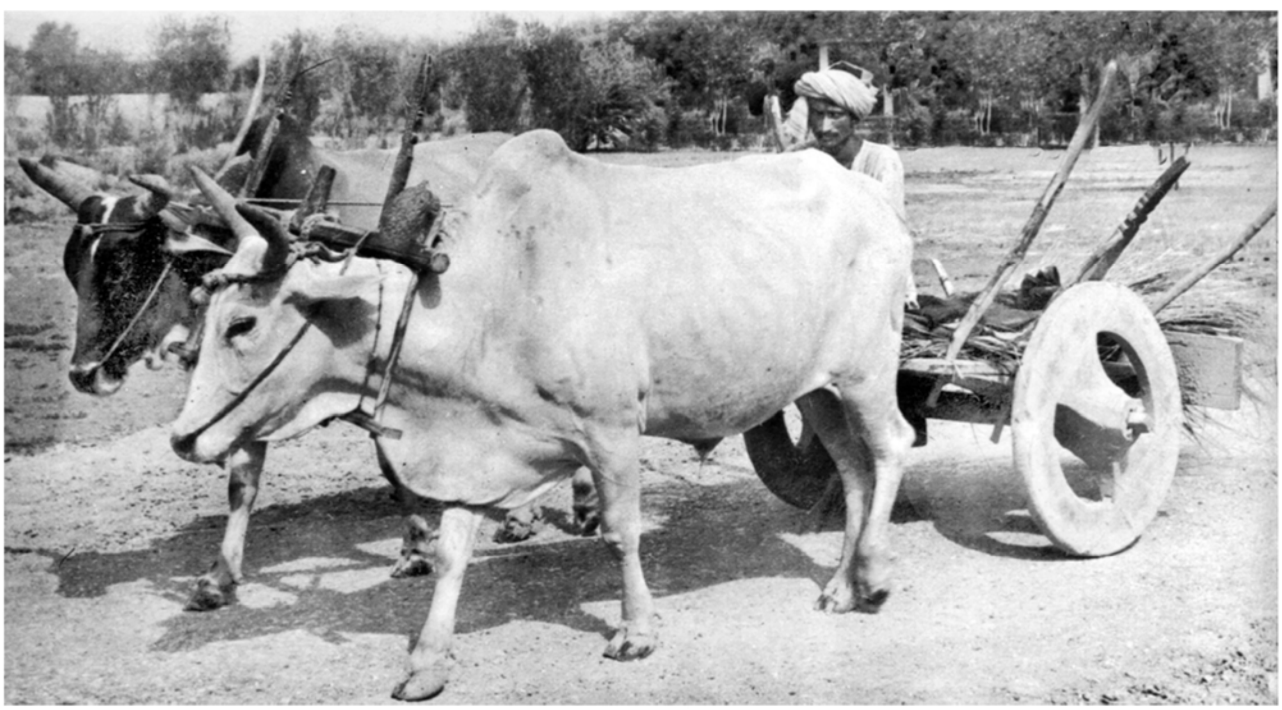
- An entirely new canal called Akram Wah with its head portion of 38 miles lined.
- Conversion of Keenjhar, Sonehri and a few other small lakes into one big lake now called 'Keenjhar Lake', having total storage of 0.525 MAF and live storage of 0.37 MAFs.
- Keenjhar Lake forming an integral part of irrigation system on the right bank. Kalri-Baghar Feeder (Upper) out falls in the lake at its northern tip at Chull and Lower Kalri-Baghar with design discharge of 6954 cusecs, off-takes

from Keenjhar lake at the, lower or southern end of the lake.

- Excavation and construction of 929.32 miles of new channels.
- Providing perennial irrigation for 839,600 acres and non-perennial for 1,967,200 areas of cultivable command area.
- On the persistent demand of cultivators of right bank for supply of silt laden water a new Link Canal 21.5 miles in length, bypassing Keenjhar Lake, off-taking Kalri-Baghar (upper) and joining with Kalri-Baghar (lower) was commissioned in 1970.
- Remodelling of 1075 miles of old channels.
- Providing annually 0.354 MAF of water to Karachi Municipal Corporation for its domestic use.

SOME IMPORTANT DATA ON KOTRI BARRAGE DRAINAGE SUPPLY TABLE

1.	Estimated cost of the project (as per revised PCI of 1980)	Rs.810.0 millions
2.	Maximum designed river discharge capacity of barrage	875 millions cusecs
3.	Maximum flood discharge (1958) of barrage	0.981 millions cusecs
4.	Length of the barrage between abutments	2984 feet
5.	Number of spans	44
6.	Width of spans	60 feet
7.	Gross area commanded	3.39 million acres
8.	Culturable command area	3.013 million acres
9.	Annual cultivation achieved (1979-80)	1.77 million acres
10.	Length of canals	252 miles
11.	Number of structures	792 Nos



881. Bullock cart which dominated transport from Kot Dijjian times to 2000 AD in Sindh, is fast disappearing and is being replaced by donkey cart with rubber tyres for short hauls and motorised pickups for long distances in rural Sindh. There may be no bullock cart except museums in Sindh after current decade.

CHAPTER 34

GUDDU BARRAGE PROJECT: 1953 - 1962 AD

With substantial progress having been made on Kotri Barrage project the Government of Sindh initiated work on Guddu Barrage project and in 1953, appointing A.R. Kazi as in charge of this project. The work on Kotri Barrage was completed and machinery and equipment were rendered surplus from that project. However, the work on excavation of Begari-Sindh Feeder was started with small dragline excavators and preliminary works of construction of colonies, roads, railway lines etc. started in 1953-54.

On the formation of Water and Power Development Authority (WAPDA) the project was passed on to WAPDA. Guddu being the first project of WAPDA received priority attention of persons like Ghulam Farook, Ghulam Ishaque Khan and Sial, the then Chairman and Members of Authority respectively, who took all steps to give required momentum to this project and accelerated the progress of works. The barrage was completed in 1962 and final diversion of river took place in March 1962. The right bank canal namely Begari-Sindh Feeder and Desert-Pat Feeder started getting barrage controlled supplies in May and July 1962 respectively. The Ghotki Feeder, however, was connected with the headworks a year later and it started to operate as barrage canal in June 1963.

- A dry crop canal namely Kacha Kharif Feeder (22 miles in length) was introduced in the project for irrigating riverine area of 22,873 acres.
- A canal called Pat Feeder for irrigating about 0.6 million acres of Balochistan area was incorporated in the project.
- A new feeder canal, the biggest in the province, namely Begari-Sindh Feeder (78.6 miles in length) with 14,764 cusecs designed discharge was commissioned.
- The new Pat Feeder was joined with Desert Canal and a common feeder was called Desert-Pat Feeder with design discharge of 13,275 cusecs and head was provided.
- On the left bank 37,026 acres of riverine area were protected by 36 miles of river protection bunds i.e., Baiji, Ranwati and Qadirpur.
- The project involved construction of 405 regulators, 643 bridges and 722 other structures of all descriptions.
- New canals 179 in number and 1040 miles in length were remodelled.

Name of feeder	Design discharge cusecs	B.W	Length miles	Command cultivated (acres) 000	Cropping pattern
B.S. Feeder	14,764	240	78.6	10.02	Rice
Desert Pat Feeder	13,275	240	7.5	5.12	Rice
Ghotki Feeder	8,490	193	79.6	8.57	Cotton

TABLE SHOWING DATA OF FEEDERS

i.	Estimated revised cost (1980) (Rs. In milllions)	796.9
ii.	Maximum designed river discharge (million cusecs)	1.2
iii.	Maximum flood discharge (1976) (million cusecs)	1.2
iv.	Length of the barrage (feet)	4,445 feet
v.	Numbers of spans	64
vi.	Width of spans (feet)	60
vii.	Gross area commanded (acres in millions)	3.269
viii.	Culturable command area (acres in millions)	3.030
ix.	Designed full supply discharge canal (cusecs)	36,529 cusecs
x.	Annual cultivation achieved: (1979/80) (million acres)	2.49
	Total length of all canals, branches, distributaries and minors (miles)	2,604

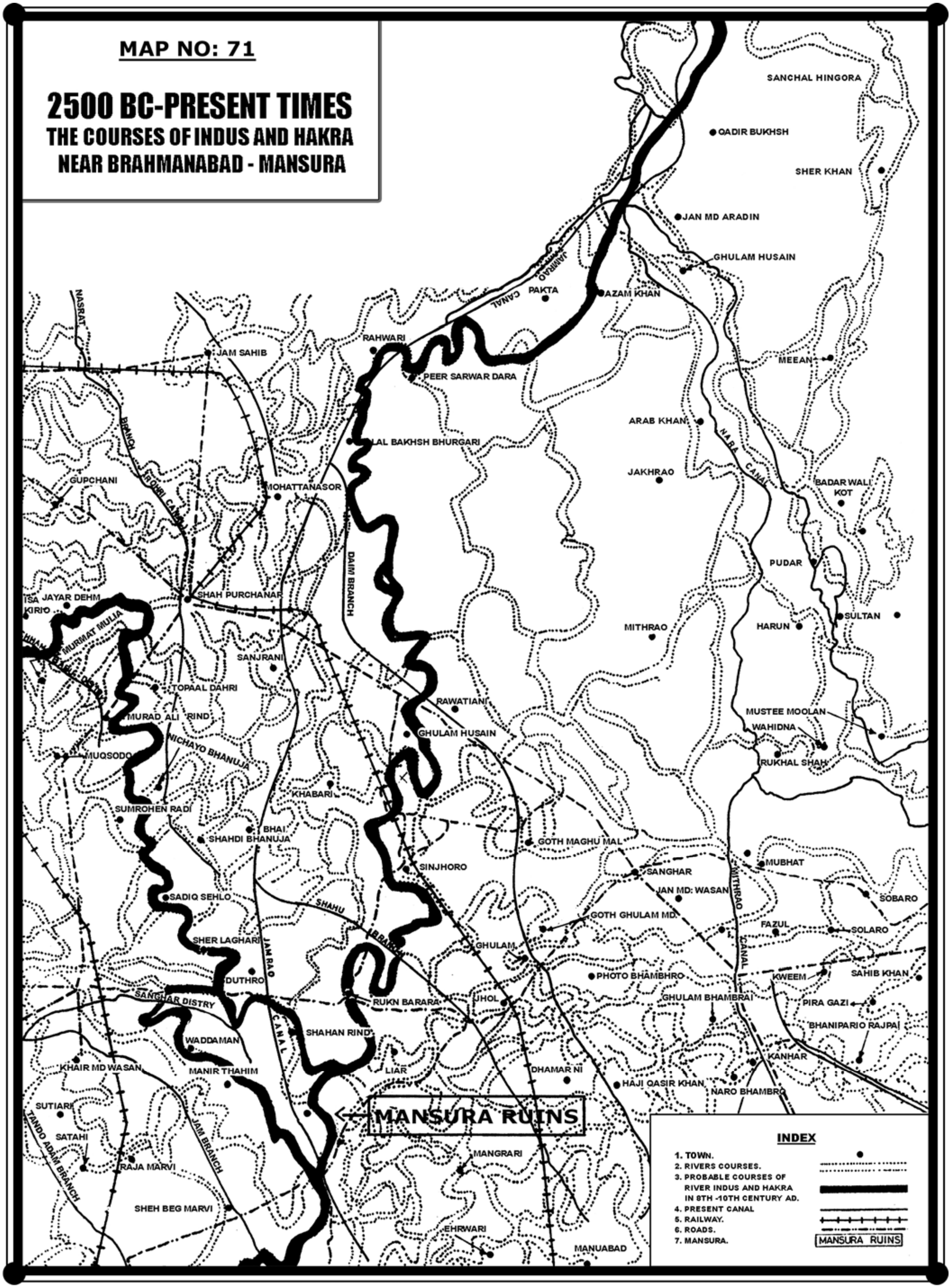

MAP NO: 71
2500 BC-PRESENT TIMES
THE COURSES OF INDUS AND HAKRA
NEAR BRAHMANABAD - MANSURA
SANCHAL HINGORA
QADIR BUKHSH
SHER KHAN
JAN MD ARADIN
GHULAM HUSAIN
JAMRAO CANAL
PAKTA
AZAM KHAN
NASRAT
JAM SAHIB
RAHWARI
PEER SARWAR DARA
MEEAN
ARAB KHAN
NARA CANAL
LAL BAKHSH BHURGARI
ROHRI CANAL BRANCH
GUPCHANI
MOHATTANASOR
JAKHRAO
BADAR WALI KOT
DAIM BRANCH
PUDAR
SHAH PURCHANAR
JAYAR DEHM
ISA KIRIO
SULTAN
HARUN
MITHRAO
MURMAT MULIA
SANJRANI
TOPAAL DAHRI
RAWATIANI
MURAD ALI RIND
MUSTEE MOOLAN
WAHIDNA
GHULAM HUSAIN
MUQSODO
NICHAYO BHANUJA
RUKHAL SHAH
KHABARI
SUMROHEN RADI
BHAI
SHAHDI BHANUJA
GOTH MAGHU MAL
MUBHAT
SINJHORO
SANGHAR
JAN MD: WASAN
MITHRAO CANAL
SADIQ SEHLO
SHAHU BRANCH
SOBARO
GOTH GHULAM MD.
FAZUL
SOLARO
SHER LAGHARI
GHULAM
JAMRAO CANAL
DUTHRO
PHOTO BHAMBHRO
KWEEM
SAHIB KHAN
SANGHAR DISTRY
RUKN BARARA
JHOL
GHULAM BHAMBRAI
PIRA GAZI
BHANIPARIO RAJPAI
WADDAMAN
SHAHAN RIND
KANHAR
KHAIR MD WASAN
MANIR THAHIM
LIAR
DHAMAR NI
HAJI QASIR KHAN
NARO BHAMBRO
SUTIARI
MANSURA RUINS
SATAHI
TANDO ADAM BRANCH
JAM BRANCH
RAJA MARVI
MANGRARI
SHEH BEG MARVI
EHRWARI
MANUABAD
INDEX
1. TOWN.
2. RIVERS COURSES.
3. PROBABLE COURSES OF RIVER INDUS AND HAKRA IN 8TH -10TH CENTURY AD.
4. PRESENT CANAL
5. RAILWAY.
6. ROADS.
7. MANSURA.
MANSURA RUINS

TABLE SHOWING SALIENT FEATURES OF GUDDU BARRGE

CHAPTER 35

POST-INDEPENDENCE DEVELOPMENTS IN SUKKUR BARRAGE: 1947-1985 AD

MAKHI FOREST DEVELOPMENT

A large area measuring about 50,000 acres was under Makhi forest. With the pressure of population and the government campaign for growing more food it was decided to deforest this area and colonise it under Military Families Rehabilitation Scheme. Accordingly, a new channel namely Samatri was constructed and two old ones namely Heran and. As per Sukkur Barrage Project an area of 23,000 acres in Rohri and Nara talukas of Khairpur was planned to receive lift irrigation from the Nara canal.

SETHARKI DISTRIBUTARY

In late fifties another scheme of colonization, for retired army personnel, was launched in Nawabshah district, and an area of 4,000 acres was provided with irrigation supplied by a new canal called Setharki distributary with designed discharge of 15 cusecs, at head, and 14 miles length. This was extended in 1979/80 by 4 miles, to provide better irrigation facilities to the area at the tail end.

SEVEN NARA CANAL CHANNELS

In the absence of electric power only a fraction of this area could be brought under cultivation in private sector by diesel powered lift pumps. The government of Sindh, therefore, in year 1954-55 launched a project constructing seven channels; three on the right and four on the left bank of Nara canal. These channels, with cultivated command area of 22,769 acres and total length of 30 miles, were constructed and completed in year 1955. Three more projects of Beghded were extended and remodelled in 1954, and area colonised.

As an extension of this scheme, two more channels were excavated from the Jamrao canal in mid sixties. These were called Ex-Sadrat-I and Sadrat-II feeders, with discharge of 188 cusecs, and were excavated for irrigating 56,000 acres of land. The total cultivated command area of Makhi area, brought under irrigation, was 128,000 areas as shown in table below:

Feeder canals	Cultivated command (acres)	Design discharge (cusecs)
Samatri	22,192	68.57
Sadrat-I	7,264	24.89
Sadrat-II	28,899	92.6
Feeder Ex- Sadrat II	9,444	27.4
Feeder Ex-Sadrat-I	10,595	33.34
Total	78,424	256.8

Lift channels were also launched in year 1967-68, 1972-73, 1979-80 and 1981-82. Under these projects further area of 67,710 acres was brought under irrigation by constructing 13 channels of total length of 40 miles and an aggregate discharge of 188 cusecs.

SHAH AWAIS AND OTHER FOUR CHANNELS BELOW SEHWAN ON RIGHT BANK

On the right bank of the River Indus, between Sehwan and Jamshoro, lies the Khirthar range of hills, with ground sloping from foot of hills in a

narrow belt of 90 miles in length. The irrigation network of right bank canals of Sukkur Barrage system terminates at Sehwan, and these fertile lands had no source of reliable irrigation. It was, however, prone to receive spill irrigation from Indus, when in floods, and from Khirthar hills streams, during period of high precipitation.

In year 1954-55 the Government of Sindh launched a project called Shah Awais Pumping Scheme, with headwork near Sann town. Three pumps of 44 cusecs capacity were mounted on barges, which provided 83 cusecs during Kharif season for irrigating a settled area of 19,392 acres. Due to its success four more pumping schemes of same type have been commissioned on the right bank below Sehwan.

DANISTAR CANAL

The tail command of Dadu had been the victim of serious shortage of water. The main causes being the changes in cropping pattern specially in upper reach of Dadu canal - from dry crops to rice, and inadequate water allowance of 2.7 cusecs per 1,000 acres, which in the arid climate, as that of Sindh, provides Kharif; intensity of only 22%, dry crops and Rabi (winter); intensity of 43%. The tail ends also got no water. In view of demand of cultivators of Sehwan and Bubak area Danistar canal, which was an old inundation canal, Ex-Manchar, but was closed during Sukkur Barrage Project, was revived in 1972. A canal 12 miles in length between the river Flood Protective Bund and the Manchar Containing Bund, with regulators at both ends and bed width of 50 feet at uniform level, was excavated in the abandoned bed of the Danistar canal. The benefit of Danistar has been increased by excavating Phitto Wah, Ex-Danistar.

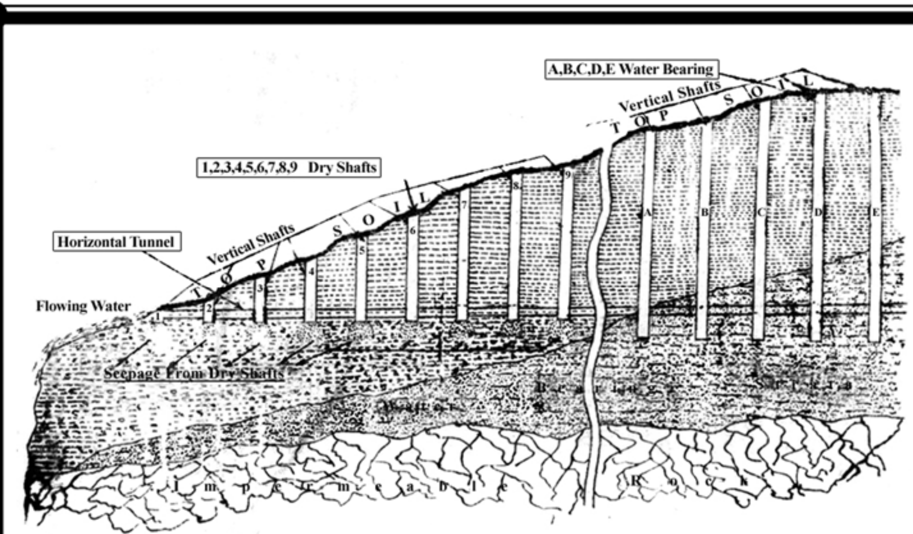
The entire system provides lift irrigation only. The canal during summer flowed from river to Manchar Lake in most years and helped in supplemental filling of Manchar, and in winter it drew water from Manchar Lake for irrigation. But in recent droughts the Manchar gets water neither from the River Indus nor from rain-fed streams, and area is deserted.

MATLI BRANCH (1978-79)

Like Dadu Distributary tail of Rohri canal system, especially in Hyderabad-Matli area, experienced serious shortage of irrigation supplies. These areas, which once flourished, had turned barren. In order to improve the lot of farmers of this area the government in 1978/79 sanctioned Matli Branch Project, which comprised of a canal Ex-Phuleli, and after siphoning Akram Wah supplies to the area settled on the tail reaches of Baran, Khachar, Soomrak, Tando Ghulam Ali, and Bhuhro etc. Similarly two lift channels Ex-Phuleli, carrying supplies across Akram Wah by aqueducts, have been constructed for the tail areas of Muhammad Khan distributary and Seri Fazal minor.

SHAH LATIF MINOR

A new channel called Shah Latif minor taking off from Rohri canal, one mile up-stream of Khesano regulator, 4.3 miles long and with 20 cusecs discharge, was constructed and commissioned in 1980.



882. Karez. Introduction of Kareze's in Baluchistan is attributed to Achaemenias. The figure shows principles of Karez.Present writer found that in Karez water masses during the year can be 42%. Karezes were dried in 1960 to 1980 by putting deep dug wells below the level of Karez water galleries and pumping them. A few are now maintained in Baluchistan as an archaeological curosity at exorbitant cost.

CHAPTER 36

WATER-LOGGING AND SALINITY — THE CONSEQUENCES OF IRRIGATION

In spite of its economic advantages, the consequences of irrigation are water-logging and salinity. By 1875 the British engineers in India had considered the water-logging hazards which were bound to appear as a result of assured gravity flow supplies, coupled with primitive methods of farming. But looking to the extent of state land and the low density of population tract then they could not foresee the growth rate in area under cropping and density of population, which after the functioning of the canals surpassed all the calculated limits. The loan obtained from the then Government of India for construction of gigantic Sukkur Barrage was repaid by Sindh in 13 years, much earlier than the scheduled period of 25 years, due to the growth rate.

After construction of the other two barrages, namely the Kotri Barrage and the Guddu Barrage, the menace of water-logging and salinity spread at alarming rate, and has seriously engulfed the entire province. Gravity of the situation can be judged from the facts given in table below, which indicates the yearly increase of the problem.

CANAL COMMAND WISE DEPTH TO WATER TABLE (OCTOBER 1989), AREA UNDER VARIOUS DEPTH TO WATER TABLE (RANGES THOUSAND HECTARES)

DESCRIPTION	0-90 cms	90-150 Cms	150-300 cms	300-450 cms	450 cms	Total Thousand hectares
GUDDU BARRAGE						
Pat Feeder	1.90	15.30	-	-	-	17.20
Desert Canal	89.30	8.70	-	-	-	98.00
Begari Sindh Feeder	359.60	66.00	3.00	-	-	428.60
Ghotki Feeder	149.70	115.90	117.40	6.00	-	389.00
Total	**600.50**	**205.90**	**120.40**	**6.00**	**-**	**932.80**
SUKKUR BARRAGE						
North Western Canal	394.80	40.30	-	-	-	435.10
Rice Canal	222.70	18.30	-	-	-	241.00
Dadu Canal	145.00	38.80	35.80	21.40	14.00	255.00
Nara Canal	130.90	316.17	305.26	165.05	99.62	1017.00
Khairpur Feeder East	35.89	84.64	76.82	26.25	7.40	231.00
Rohri Canal	50.61	202.37	504.34	253.10	184.58	1195.00
Khairpur Feeder West	10.38	52.75	52.53	3.95	1.39	121.00
Total	**990.28**	**753.33**	**974.75**	**469.75**	**306.99**	**3495.10**
KOTRI BARRAGE						
Kalri Baghar Feeder	8.68	212.51	56.81	-	-	278.00
Lined channel	12.76	158.31	64.93	-	-	236.00
Phuleli Canal	130.00	253.78	25.22	-	-	409.00
Pinyari feeder	130.65	209.13	43.78	1.44	-	385.00
Total	**282.09**	**833.73**	**190.74**	**1.44**	**-**	**1308.00**
GRAND TOTAL	**1872.87**	**1792.96**	**1285.89**	**477.19**	**306.99**	**5735.90**

The Federal Government of Pakistan having realised the menace of water-logging and salinity, as a national problem, decided to finance the projects of water-logging and salinity control under a program known as "Accelerated Program of Anti-Water-logging and Salinity Control Measures". This program is being implemented by WAPDA. Details of water-logging and salinity projects under the above program, implemented and being implemented in Sindh are:

PROJECTS COMPLETED	
1. SCARP- Khairpur	540 tube-wells were made operative in 1970. Area covered; 38 million acres
2. Larkana-Shikarpur Surface Drainage Project Stage-I	Only main drains were completed in 1969. Area covered; 587 million acres
3. Shikarpur Pilot Tube-well Project	50 tube-wells were made operative since 1974 in Fresh Ground Water Zone. Area covered; 14,380 acres
4. Larkana Pilot Tube-well Project	35 tube-wells were made operative since 1974 in Fresh Ground Water Zone. Area covered; 5021 acres
5. Sukkur Pilot Tube-well Project	18 tube-wells were made operative in 1975 in Fresh Ground Water Zone. Area covered; 5100 acres
6. Kandhkot Pilot Tube-well Project	26 tube-wells in Fresh Ground Water Zone were made operative in 1978. Area covered; 11,940 acres
7. SCARP - Rohri North	1191 tube-wells in Fresh Ground Water were made operative during 1974-75. Area covered; 0.69 million acres
8. Sukkur Right Bank Tube-well Project	408 tube-wells in Fresh Ground Water Zone made operative in 1976. Area covered; 13 million acres
9. Larkana-Shikarpur Surface Drainage Project Stage-II	Network of sub-drains and structures in progress. Area covered is 589 million acres
10. Rohri South Tube-well Project in Fresh Ground Water Zone (350 tube-wells)	It covers an area of 0.475 million acres
11. Ghotki Tube-well Project in Fresh Ground Water Zone (398 tube-wells)	It covers an area of 0.4 million acres
12. East Khairpur Tile Drainage Project	It covers an area of 44,000 acres
PROJECTS IN PROGRESS	
1. Left Bank Out-fall Drain Stage	It covers Sanghar, Nawabshah and Mirpurkhas districts
2. Kotri Surface Drainage Project	It covers an area of 0.28 million acres
3. North Dadu Surface Drainage Project	It covers an area of 0.445 million acres
DRAINAGE PROJECTS	
1. Gaja Tile	It will cover an area of 0.104 million acres
2. Left Bank Out-fall Drain	It covers an area of 3 million acres
3. Right Bank Out-fall Drain	It will cover an area of 0.348 million acres
4. Nawabshah Saline	It covers an area of 5 million acres
GROUND WATER PROJECTS	
1. Kandhkot-Thul-Shahdadkot Surface Drainage Project	It will cover an area of 19 million acres
2. Guddu Right Bank Fresh Ground Water Project (1027 tube-wells)	It will cover an area of 3.5 million acres
3. Khairpur South	It will cover an area of 4 million acres

APPENDIX I

KALHORA-TALPUR CANALS IMPROVED BY THE BRITISH DURING FIRST 30 YEARS OF THEIR RULE 1849 - 1873 AD

These were produced in the Irrigation Departments report for 1873 and Hugh's Gazetteer of Sind", 1876. The spellings used were not standardised and author has tried to give modern spellings, where known, but to correct and rewrite all names of canals, Tapas, dhandhs and village special research efforts are needed.

CANALS IN FRONTIER DISTRICT (1876)

S.No.	Name of canal	Length (mile)	Width at mouth (feet)	Remarks
1.	Begari	85	75	Main feeder; taps the Indus at the extreme south-eastern boundary of the Frontier Jacobabad district
2.	Sone Wah	19	24	Is a branch of the Begari striking off from it in the Thul taluka
3.	Mirza Wah	9 1/3	26	A branch of the Begari striking off from it in the Thul taluka
4.	Noor Wah	19	30	A branch of the Begari
5.	Bud Wah	4	10	A branch of the Noor Wah
6.	Desert canal	35	26	Taps the Indus in the Kashmore taluka

HALA DEPUTY COLLECTORATE

S.No.	Name of canal	Length in miles	Width at mouth in feet	Remarks
1.	Ali Bahar	32	20	Taps the Indus at Nakur, Taluka Sakrand; waters the Tapas of Chachri and Ali Bandar
2.	Sobo Chakar Wah	6	6	Branch of the Ali Bahar
3.	Barhun Wah	15	11	Branch of the Ali Bahar
4.	Sumer Wah	5	9	Branch of the Barhun Wah
5.	Manjri Wah	4	7	Branch of the Sumer Wah
6.	Musa Wah	3	7	Branch of the Sumer Wah
7.	Khahi Wah	2	7	Branch of the Musa Wah
8.	Yarhun Wah	7	7	Branch of the Ali Bahar
9.	Ali Ganj	7	7	Branch of the Yarhun Wah

10.	Marak (great) and Vahandri	10	28	Taps the Indus at Nakur, Taluka, Sakrand; waters Tapas of Saidabad and Chachri; is navigable
11.	Jam Wah	8	11	Branch of the Marak (great)
12.	Lohano (great)	27	17	Branch of the Vahandri; is navigable
13.	Mahmud Wah	16	8	Branch of the Lohano
14.	Bahram Wah	8	8	Branch of the Lohano
15.	Ganj Bahar	6	20	Branch of the vahandri; is navigable
16.	Lohano (small)	7	20	Branch of the Ganj Bahar; is navigable
17.	Jam Wah (great)	9	16	Branch of the Lohano; is navigable
18.	Raj Wah	4	6	Branch of the Lohano; is navigable
19.	Jam Wah	6	6	Branch of the Jam Wah
20.	Bhobhar Wah	2	7	Branch of the Jam Wah (great)
21.	Nindo Wah	2	7	Branch of the Bhobhar Wah
22.	Shah Wah	27	18	Branch of the Lohano-Koli; is navigable
23.	Shahdad Landhi	13	10	Branch of the Shah Wah
24.	Huzur Wah	9	7	Branch of the Shahdad Landhi
25.	Shahdad Jhol	11	11	Branch of the Shah Wah
26.	Shahdad Wah Kario	3	8	Branch of the Shahdad Jhol
27.	Wangi Bijar Wah	5	8	Branch of the Shah Wah
28.	Bijar Wah	15	8	Branch of the Shah Wah
29.	Khair Wah	4	8	Branch of the Shah Wah
30.	Muhammad Ali Wah	9	8	Branch of the Shah Wah
31.	Gharo, great (with Gharo & Bhanot)	20	75	Taps the Indus at Bhanot, tapa Hala; waters the tapas of Hala and Saidabad; is navigable
32.	Upau Wah	5	6	Branch of the Awat Wah
33.	Malko Wanghero	4	9	From the Dhandh Gahot
34.	Laki Wah	8	8	From the Gharo Bhanot
35.	Sarang Wah	16	14	From the Gharo Bhanot
36.	Ali Ganj	13	14	From the Gharo; is navigable
37.	Noor Wah	2	10	Taps the Indus at Hakur, tapa Hala; waters the Saidabad tapa
38.	Sangro Wah and Tyr-whitt Wah Mahmuda	42	23	Tapa Hala; is navigable
39.	Kario Agokapri	4 ½	11	Branch of the Sangro Wah
40.	Dosa Wah	15 ½	18	From the Sangro; is navigable
41.	Kario Naubat	3	6	From the Dosa Wah
42.	Sangro (small)	7	15	From the Sangro Wah (great)
43.	Piru Wah	8	10	From the Sangro
44.	Landar Wah	4	6	From the Piru Wah

45.	Mir Wah Kathri	3	8	From the Piru Wah
46.	Nawak Wah	4	15	From the Sangro (small); is navigable
47.	Bhmuphar Wah	6	10	From the Nawak Wah
48.	Kahu Wah	14	14	From the Kahu Wah
49.	Lundo Wah	5	8	From the Kahu Wah
50.	Let Wah	15 ½	12	Brach of the Nawak Wah; is navigable
51.	Ali Bahar	20	15	Taps the Indus at Mehar, Tapa Hala
52.	Kari Shumali	1	36	Taps Indus at Khandu, tapa Hala; water the Bhit Shah and Sekhat tapas
53.	Ghalu Wah	48	36	Branch of the Kari Shumali
54.	Khalak Wah	6	10	Branch of the Khalak Wah
55.	Bhumphar Wah	21	10	Branch of the Ghalu Wah
56.	Alahkhai Wah	10	8	Branch of the Ghalu Wah
57.	Khan Wah	5	8	Branch of the Ghalu Wah
58.	Niri Ghalu	1	8	Branch of the Ghalu Wah
59.	Abul Wah	5	8	Branch of the Niri Ghalu
60.	Bijar Wah	12	6	Branch of the Niri Ghalu
61.	Nangnani	25	9	Branch of the Ghalu Wah
62.	Murad Wah	4	6	Branch of the Nangnani
63.	Dhoro Ghalu	7 ½	16	Branch of the Ghalu Wah
64.	Jarwar Wah	13 ½	8	Branch of the Dhoro Ghalu
65.	Sanhro Wah	18	11	Branch of the Dhoro Ghalu
66.	Chhahon Wah	9 ½	8	Branch of the Sanhro Wah
67.	Manjir Wah	4	6	Branch of the Sanhro Wah
68.	Mir Wah (great)	25	14	Branch of the Dhoro Ghalu
69.	Belharo Wah	6	7	Branch of the Mir Wah (great)
70.	Mir Wah-Mari	5 ½	4	Branch of the Mir Wah (great)
71.	Nasir Wah	27	28	Taps the Indus at Jakri, taluka Hala; waters the Sekhat and Matiari tapas; is navigable
72.	Khari Wah	4	7	Branch of the Nasir Wah
73.	Gun Wah	4	8	Branch of the Nasir Wah
74.	Sujawal Wah	4	7	Branch of the Nasir Wah
75.	Sone Wah	10	8	Branch of the Gahoro Wah
76.	Siri Wah	10	8	Branch of the Sone Wah
77.	Kario Mir Ahmad Khan	2	5	Branch of the Gahoro Wah
78.	Gahoro Wah	13	15	Branch of the Nasir Wah
79.	Khesano Wah	21	14	Branch of the Nasir Wah
80.	Kamal Wah	2	4	Branch of the Khesano Wah

81.	Jamal Wah	2	4	Branch of the Khesano Wah
82.	Jam Wah	13	6	Branch of the Khesano Wah
83.	Ram Wah	5	6	Branch of the Jam Wah
84.	Mir Wah	9	6	Branch of the Jam Wah
85.	Gharib Wah	10	10	Branch of the Jam Wah
86.	Bhuri Wah	5	7	Taps the Indus at Saheb Lamo, taluka Hala; waters tapa of Matiari
87.	Sarfaraz Wah	77	19	Taps Indus at Sadik Memon, taluka Hala; waters Matiari, Nasarpur and Khokhar tapas; is navigable
88.	Imam Wah	35	10	Branch of the Phuleli, taluka Hyderabad
89.	Bahram Wah	4	9	Branch of the Imam Wah

HYDERABAD TALUKA (1876)

23.	Khair Wah Jagir	1 ½	5	Branch of the Husri
24.	Kario Kasim	2	7	Branch of the Husri
25.	Bag Wah	5	6	Branch of the Husri
26.	Ali Bahr Wah	1	5	Branch of the Husri
27.	Husri Wah	4	7	Branch of the Husri
28.	Ado Wah	1	5	Branch of the Husri
29.	Bandi Wah	2/3	6	Branch of the Phuleli (old)
30.	Khair Wah Khathar	3	7	Branch of the Imam Wah Husri
31.	Mir Wah Khathar	2	7	Branch of the Husri
32.	Chhandan Wah	2/3	7	Branch of the Husri
33.	Phuleli Gundar Wah	1	4	Branch of the Husri
34.	Baghar Wah	2	7	Branch of the Husri
35.	Farid Wah	2/3	5	Branch of the Husri
36.	Chhandan Dara	1	12	Taps Indus near village of Haji Bhara
37.	Kangan Khadhi	7	11	Branch of the Chhandan Wah
38.	Masgi Wah	6	4	Branch of the Chhandan Wah
39.	Jindu Wah	2 ½	4	Branch of the Chhandan Wah
40.	Ali Thahim Wah	2	4	Branch of the Chhandan Wah
41.	Shaitan Wah	¾	6	Branch of the Chhandan Wah
42.	Hazari Wah	2	4	Branch of the Chhandan Wah
43.	Kafi Wah	¾	4	Branch of the Phuleli (new)

JHERRUCK DEPUTY COLLECTORATE (1876)

S.No.	Name of Canal	Length in miles	Width at mouth in feet	Remarks
1.	Sapah	2	11	Is a main-feeder; taps the Indus in the Shah tapa, through which it flows
2.	Khair Wah	1	6	A branch of the Sapah
3.	Chhandan	2	-	Main feeder; taps the Indus in the Shal tapa, through which it flows
4.	Jam Wah	4	10	Main feeder; taps the Indus in the Sonda tapa, through which it flows also
5.	Haji Wah	6	11	Main feeder; taps the Indus in the Sonda Tapa, through which it flows also
6.	Sultan Wah	2	7	Main feeder; taps the Indus in the Sonda tapa, through which it flows also
7.	Ali Bahar	6	13	Main-feeder; taps the Indus in the Sonda Tapa, through which it flows also
8.	Ghari	3	6	A branch of the Ali Bahar
9.	Gidar Wah	4	12	Main feeder; taps the Indus in the Sonda tapa, which it waters

10.	Khatian	4	9	Main feeder; taps the Indus in the Chilia tapa, which it irrigates
11.	Kalri	50	40	Main feeder; taps the Indus in the Chilia tapa, flows through Gujo and Chilia tapas, tailing off in the former
12.	Nari Chhachh	2	30	Branch of the Kalri
13.	Sada Bahar	3	7	Branch of the Kalri
14.	Alahkhai (old)	12	18	Branch of the Kalri
15.	Jam Wah	4	9	Branch of the Kalri
16.	Ghar Kalan	3	25	Branch of the Kalri
17.	Alahkhai (new)	3	-	Branch of the Kalri
18.	Ghar Sonaki	2	-	Branch of the Kalri
19.	Ghar Masan	5	10	Branch of the Kalri
20.	Ghar Machhi	5	10	Branch of the Kalri
21.	Lundi	2	-	Branch of the Kalri
22.	Khan Wah	9	20	Branch of the Kalri
23.	Jam Wah	7	9	Branch of the Kalri
24.	Baghar (old)	56	-	Main feeder and branch of the Indus, which it taps in the Garko tapa; watering that and the Bijoro tapa and tailing off in the Sakro taluka
25.	Sonaki	5	10	Branch of the Baghar
26.	Jam Wah	5	9	Branch of the Baghar
27.	Nasir	9	13	Branch of the Baghar
28.	Khati Wah	7	8	Branch of the Baghar
29.	Raj Wah (I)	5	-	Branch of the Baghar
30.	Ghar Jhagi	3	10	Branch of the Baghar
31.	Raj Wah (2)	2	15	Branch of the Baghar
32.	Malka	4	9	Branch of the Baghar
33.	Dor Wah	5	8	Branch of the Baghar
34.	Daro	5	8	Branch of the Baghar
35.	Ladia	5	8	Branch of the Baghar
36.	Jhor	7	12	Branch of the Baghar
37.	Ghar Baharki	3	12	Branch of the Baghar
38.	Mir Wah Kalan	9	14	Main feeder; taps the Indus in Garko tapa, which it irrigates
39.	Nari Chhachh	2	11	Main feeder; taps the Indus in Bhiman tapa, which it irrigates
40.	Ghar Marah	6	16	Branch of the Nari Chhachh
41.	Nari Gulel	1	10	Main feeder; taps Indus in Bhiman tapa, which it waters

42.	Siathri (or Badalshah)	2	9	Main feeder; taps Indus in Bhiman tapa, which it waters
43.	Nasir Wah	8	18	Main feeder; taps the Indus in the Bhiman tapa, waters that and the Mahr tapas
44.	Ochto	34	-	A natural branch of the Indus and another name for the Hajamro. Floods from the canal occur in the Ghorabari taluka; it waters the Daulatpur, Mahr, Garha, Khatho, Ghorabari and Keti Bandar tapas
45.	Makri	4	-	Branch of the Ochto
46.	Khanani	5	-	Branch of the Ochto
47.	Khatho	3	-	Branch of the Ochto
48.	Sian	27	-	Natural branch of the Indus; waters the Daulatpur tapa and tails off there
49.	Ghoro	4	-	Main feeder; taps the Indus near the village of Pir Kanjrio in Ghorabari tapa, which it waters

LARKANA DEPUTY COLLECTORATE (1876)

S.No.	Name of canal	Length in miles	Width at mouth in feet	Remarks
1.	Nasar Wah	11	28	A branch from the Ghar canal; flows through the tapas of Nau Dero, Khan Wah, Rato Dero and Bangul Dero
2.	Ghar	22	80	Main feeder; taps Indus near Madeji in Shikarpur and Sukkur divisions and flows through Nau Dero, Mahota, Larkana and Biro Chandio tapas
3.	Nara (western)	30	100	Main feeder; taps Indus on the boundary of the Shikarpur and Sukkur divisions, but its mouth is constantly changing
4.	Ford Wah (It was a British canal)	5	100	Joins the Nara and Ghar, flowing through the Aqil and Mahota tapas; was originally intended for a boat canal, but its sluice is seldom if ever opened. It is so called after an able officer Capt. Ford, once Deputy Collector of the Larkana district; dug in 1855 and cost 28,560 rupees of which the Zamindars contributed 19,560 rupees
5.	Gath Wah	21	60	A branch of the Naurang; flows through the Kambar and Langh tapas for a few miles and then enters the Mehar division
6.	Chile Wah	7	60	Another branch of the Naurang, flowing for a few miles through the Kambar and Langh tapas and then entering the Mehar division
7.	Naurang Wah	21	90	Is a branch or rather continuation of the Ghar canal; waters the Biro Chandio, Kamber and Langh tapas
8.	Noor Wah	10	28	A branch of the Ghar; flows through the Iso and Dost Ali tapas, tails off into the “Altan” Dhandh near the village of Dost Ali

9.	Edam Wah	23	12	This canal used to branch from the Begari; but being intersected by the Sukkur canal, is supplied from the Shah-ji-kur in the Karda and Sanjar Bhatti tapas
10.	Gillespie Wah	10	17	A new branch canal issuing from the Nara near Nawabad and re-joining it near Bagi; Waters the Manad, Beli Gaji and Dokri tapas
11.	Bire-ji-kur	27	48	A branch of the Nasrat, flows through the Rato Dero tapa; formerly a Zamindari canal
12.	Kur Khairo Cachal	12	50	A branch of the Nasrat, flows through the Rato Dero tapa; was formerly a Zamindari canal

LARKANA ZAMINDARI CANALS

S.No.	Name of canal	Length in miles	Width at mouth in feet	Remarks
1.	Ganhwar Isran	10	35	Is a branch of the Nara, flowing through the Shaikh Fojo and Langh tapas, tails into the Chilo in the Mehar division, is cleared by the Zamindars
2.	Shah Hamir	10	70	A branch of the Ghar, flows through the Mahota and Areja tapas, tails into the Shah-ji-kur and is cleared by the Zamindars
3.	Shah-ji-kur	22	24	A branch of the Ghar, flows through the Buthi and Karda tapas, is at present the chief feeder to the Edan Wah and is cleared by Zamindars
4.	Date-ji-kur	22	24	A branch of the Ghar, flows through the Buthi and Darda tapas and tails into the Edan Wah, is cleared by the Zamindars
5.	Maksudo	6	50	Formerly a branch of the Nasrat, but now of the Sukkur Canal, flows through the Sanjar Bhati tapa
6.	Kur Mohbat	8	10	Continuation of the Noor Wah; flows through the Karda tapa
7.	Kur Sando	6	8	Continuation of the Noor Wah; flows through the Karda tapa
8.	Fatohal-jo Wah	12	12	Branch of the Noor Wah; flows through Ghaibi Khan Chandio's Jagir
9.	Khair Muhammad Kartio-jo Wah	8	8	Branch of the Naurang; flows through the Biro tapa
10.	Hir Wah	16	12	Branch of the Ghar; flows through the Mahota tapa
11.	Mir Wah	20	10	Branch of the Ghar; flows through the Nau Dero tapa
12.	Nabi Bakhsh Wah	15	6	Branch of the Nara; flows through the Larkana tapa
13.	Kadu Wah	15	5	Branch of the Nasrat; flows through the Nau Dero tapa
14.	Ghari Kathurie Budho	19	5	Branch of the Ghar; flows through the Biro Chandio tapa
15.	Khani Wah	8	5	Branch of the Ghar; flows through the Mahota tapa

16.	Ghanur Wah Duable	10	5	Branch of the Nara; flows through the Langh and Biro Chandio tapas
17.	Ghari Khokhar	12	4	Branch of the Ghar; flows through the Biro Chandio tapa
18.	Chhuto Wah	10	4	Branch of the Shah Hamir; flows through the Areja tapa
19.	Daru Wah	10	4	Branch of the Ganhwar Isran Wah; flows through the Langh tapa

MEHAR DIVISION

S.No.	Name of Canal	Length in miles	Width at mouth in feet	Remarks
1.	Nara (western)	71	60	Main feeder; taps Indus in the Larkana district in the Nasirabad taluka boundary, entering Mehar and leaving it for the Sehwan near Kakar
2.	Wahur Wah	30	80	Main feeder; taps Indus at Channa, watering the Vahar, Nao Goth, Magsi, Nari and Sita tapas and tails off into the Indus near Sita
3.	Marui	15	12	Branch of the Wahur Wah
4.	Kakol	11	20	Branch of the Western Nara
5.	Kudan	20	20	Branch of the Nara
6.	Gul Muhammad Wah	7	10	Branch of the Western Nara. Revenue included in the Ford Wah
7.	Gath Wah	4	50	Branch of the Naurang Wah, a canal in the Larkana district
8.	Chilo Wah	12	15	Branch of the Naurang Wah
9.	Naiser Wah	22	20	Branch of the Gath Wah

ZAMINDARI CANALS

S.No.	Name of Canal	Length in miles	Width at mouth in feet	Remarks
1.	Ganhwar Isran	-	-	Branch of the Nara
2.	Raj Wah	12	10	Branch of the Nara
3.	Kaim Shah Wah	6	10	Branch of the Kakol
4.	Nabi Bakhsh Wah	8	12	Branch of the Nara
5.	Nasir Wah	8	12	Branch of the Nara

NAUSHEHRO SUBDIVISION

S.No.	Name of Canal	Length in miles	Width at mouth in feet	Remarks
1.	Chato	3	35	Taps Indus in Khairpur State, the revenue is taken by H.H Mir Ali Murad; is navigable
2.	Ghar kun	13	14	Branch of the Chato
3.	Bahman	3	6	Branch of the Chato

4.	Mahrab	36	15	Branch of the Chato, is navigable
5.	Rede Wah	5	5	Branch of the Chato
6.	Nasrat	30	32	Taps Indus in Mohbat Dero forest; water the Gul Shah, Shekhani, Halani, Kandiaro, Lakha and Bhiria tapas; is navigable
7.	Fatima Wah	16	19	Branch of the Nasart Wah
8.	Madad Wah	9	8	Branch of the Nasart Wah
9.	Lundi	8	6	Branch of the Nasart Wah
10.	Naulakhi	25	42	Taps Indus at the Bhanwar forest; waters the Behelkani, Kamal Dero, Kandiaro, Darbelo, Tharushah and Naushehro tapas, tailing off at Mohan-jo-Goth; is navigable
11.	Bhur (less)	2	5	Branch of the Naulakhi
12.	Ambar Wah	9	10	Branch of the Naulakhi
13.	Imam Ali	6	8	Branch of the Naulakhi
14.	Kotai	12	10	Branch of the Naulakhi
15.	Chakar	4	6	Branch of the Kotai
16.	Fairez Wah	24	12	Branch of the Naulakhi; is navigable
17.	Dain	4 ¾	4	Branch of the Fairez Wah
18.	Murad	25 ½	12	Branch of the Naulakhi
19.	Bag Wah	27 ½	10	Branch of the Murad Wah; in navigable
20.	Haidar Wah	4	6	Branch of the Bag Wah
21.	Bahar (greater)	3	14	Taps Indus at Adam-jo-Goth and waters the Kamal Dero and Abad tapas, tailing off a Khairo Dero in the Naushehro taluka
22.	Dhambro Wah	9 ½	14	Taps Indus at Dalipota-jo-Goth and waters the Abji and Bhiria tapas, tailing off at Dhero Khat in the Moro taluka
23.	Mir Wah	7 ½	6	Branch of the Dhambro Wah
24.	Mohbat	13 ½	8	Branch of the Mir Wah
25.	Alawal Wah	3 ½	5	Branch of the Mir Wah
26.	Khair Wah	3 ½	6	Branch of the Mohbat Wah
27.	Chakar Wah	3 ½	6	Branch of the Mohbat Wah
28.	Dadhur	3 ½	7	Branch of the Mohbat Wah
29.	Dali Wah	3 ½	3 ½	Branch of the Mohbat Wah
30.	Buriri	1 ¾	4	Branch of the Mohbat Wah
31.	Lakh Wah	2 ¾	4	Branch of the Mohbat Wah
32.	Mir Wah (Sehra)	2 ¾	10	Taps Indus at Matt and waters the Abji and Sehra tapas, tailing off at Dungah village in the Moro taluka

33.	Dad Wah	32 ¾	18	Taps Indus at Mithiani and waters the Abji, Wad Pagia, Bihra, Manahi, Puran, Moro, Ghachero, Daulatpur and Sann tapas, tailing of at Yaru Dahri in the Moro taluka; is navigable
34.	Piaro Wah	3	4	Branch of the Dad Wah
35.	Khan Wah	4	4	Branch of the Dad Wah
36.	Kaim Kur Wah	4	4	Branch of the Dad Wah
37.	Alahkhai	½	8	Branch of the Dad Wah
38.	Naj Wah	3 ¾	4	Branch of the Dad Wah
39.	Suhagan	3	4	Branch of the Alahkhai
40.	Mal Wah	3	4	Branch of the Naj Wah
41.	Khajur Kur	3	4	Branch of the Mal Wah
42.	Yakhtiar	7	7	Branch of the Dad Wah
43.	Naj Wah (Raiti)	9 ½	7	Branch of the Dad Wah
44.	Jarwar Wah	8	8	Branch of the Dad Wah
45.	Mir Wah	9	8	Branch of the Jarwar Wah
46.	Gachero	6	12	Taps Indus at Haji Dero and water the Puran and Wad Pagia tapas, tailing off at the hamlet Wariaso in the Moro taluka
47.	Surat Wah	9	8	Taps Indus at Khairo Dero and water the Daulatpur tapa, tailing off in the Akhtar Wah in the Moro taluka
48.	Wahur Chrice	4	16	Taps Indus at Hanjar village, tailing off at Las Wah in the Sakrand taluka
49.	Las Wah	3 ½	12	Main feeder from the Indus
50.	Raharji Wah	6	8	Branch of the Las Wah
51.	Ghati Wah	2	5	Branch of the Raharji Wah
52.	Joo Wah	4	4	Taps Indus at Ghulam Haider-jo-Goth, tailing off at Razi Jatoi-jo-Goth in the Sakrand taluka
53.	Jali Wah	4	6	Tpas Indus at Razi Jatoi and waters the Lakhat tapa
54.	Mir Wah Kandar	3	8	Taps Indus at Lakhat and water the Lakhat tapa, tailing off at Ali Bahar Dhandh in the Sakrand taluka
55.	Ali Bahar	6	18	Taps Indus at Gohram Mari-jo-Goth and waters the Lakhat and Gohram Mari tap, tailing off in the Dhandh Biraro, Sakrand taluka
56.	Mus Wah	4	5	Branch of the Ali Bahar
57.	Khahi Wah	4	18	Taps Indus at Gohram Mari-jo-Goth, waters the Gohram Mari tapa, tailing off in Dhandh in the Sakrand taluka
58.	Upau Wah	4	4	Taps the Indus, tails off in a Dhandh in the Sakrand taluka
59.	Chari (greater)	3	6	Branch of the Khahi Wah

60.	Ren Wah	20	21	Taps Indus at Dinal-jo-Dhoro, waters the Lakhji, Sakrand and Mubarak tapas, tailing of in Dhandh Mula Sand in the Sakrand taluka, is navigable
61.	Ghari Fatehpur	2 ½	7	Branch of the Ren Wah
62.	Khan Wah	3	4	Branch of the Ghari Fatehpur
63.	Khair Wah	1 ½	4	Branch of the Ren Wah
64.	Mubarak Wah	22	12	Branch of the Ren Wah
65.	Chakar Wah	6	15	Branch of the Mubarak Wah
66.	Sohrab Wah	18 ½	10	Branch of the Chakar Wah
67.	Nar	2 ½	5	Branch of the Mubarak Wah
68.	Nezn Wah	3 ½	6	Branch of the Schrab Wah
69.	Ali Wah	19	9	Branch of the Chakar Wah
70.	Mir Wah Relri	7	2	Branch of the Ren Wah
71.	Sadarang	5 ½	7	Taps Indus at Mehrabpur, water the Lakhji and Sakrand tapas, tailing off in the Sakrand Dhandh
72.	Daria Khan	8	13	Taps Indus at Mari forest, tails off at deh Ghar Butho, Sakrand taluka
73.	Ali Bahar Kacheri	30	18	Taps Indus at Nakur, tails off in the Hala division; is navigable
74.	Ali Bahar	4 ½	8	Branch of the Daria Khan Wah

GOVERNMENT CANALS IN THE ROHRI DIVISION (1876)

S.No.	Name of Canal	Length in miles	Width at mouth in feet	Remarks
1.	Dahar Wah	26	30	Rises from the Guddu Dhoro in the Ubauro taluka, water the Kamub Shahid, Ubauro, Jhagal Malk and Khanpur tapas; on entering the Imam Wah tapa it takes the name of the Imam Wah
2.	Imam Wah	19	16	Is a continuation of the Dahar Wah, tails off among the sand hills in the Shahpur tapa
3.	Maus Wah	32	24	Rises from the Rawati Dhoro in the Ubauro taluka, waters the Rawati, Raharki, Hayat Pitafi, Jarwar and Bahari tapas, tailing off in the Khanpur tapa
4.	Maharo Wah	37	20	Rises from the Rawati Dhoro, waters the Jehanpur, Mathelo, Hayat Pitafi. Bahari and Khanpur tapas, tailing in the Shahpur tapa
5.	Lundi Wah	16	35	Taps the Indus at Tandra Nijabat in the Ghotki taluka, waters the Jehanpur and Mathelo tapas, tailing off the Adilpur tapa
6.	Dengro Wah	16	35	Rises from a Dhandh in the Sanghari tapa, waters the Adilpur tapa, tailing off in the Ruk tapa
7.	Ganj Bahar	7	12	Taps the Indus at Bakhsho Ghoto in the Ghotki taluka, waters the Dad Loi tapa, after which it changes its name to the Maharo Wah

8.	Mahesro Wah	6	12	Waters the Ruk and Dad Loi tapas, tailing off the Shahpur tapa
9.	Korai Wah	23	24	Taps the Indus at Miani in the Ghotki taluka; waters the Shahpur and Pano Akil tapas, failing into a small hollow in the Yunas tapa, which flows into the Nara
10.	Janib Wah	7	20	Taps the Indus at Panhwari in the Rohri taluka, waters the Baharo Panhwar and Yunas tapas, failing into the Gujhri Dhoro, which itself falls into the Nara
11.	Umar Khas	5	14	Taps the river Indus near Rohri, waters the Kandar tapa, tailing off into the Nara
12.	Arore Wah	16	20	A branch of the Umar Khas, waters the Arore and Kandar tapas, passing into the Khairpur State
13.	Mir Wah	2	16	Taps the Indus at Alad in the Rohri taluka, waters the Kandar tapa and runs into the Chejro Kolab in the same tapa

CANALS IN SEHWAN DEPUTY COLLECTORATE

S.No.	Name of Canal	Length in miles	Width at mouth in feet	Remarks
1.	Nara (western)	37	54	Is a continuation of the same canal, which taps the Indus in the Sukkur and Shikarpur districts; waters portions of the Dadu and Sehwan talukas and falls into the Manchar Lake
2.	Noor Wah	9	11	Branches from the Nara about two miles from Dadu; waters the Khohara Buthi and Badani tapas, falling into the Phito
3.	Karo	4	6	A branch of the Nara; flows through the Khachar tapa
4.	Garibo	2	12	A branch of the Nara; flows through the Khachar tapa
5.	Ali Ganj	4	5	Branch of Nara; waters the Badani tapa
6.	Pir Dhoro	1	6	Branch of the Nara; waters the Buthi and Kahiri tapas
7.	Danistar Wah	8	26	Rises from the Manchar at Bubak, waters the Bubak, Khabort, Arazi and Sehwan tapas
8.	Kur Kalan	3	4	Branch of the Kara; waters the Chhini tapa
9.	Kur Akatar	3	9	Rises from the Manchar, waters the Akatar tapa
10.	Shekhano	3	8	Branch of the Wadhu; flows through the Bhan tapa
11.	Sakro	1	4	Branch of the Nara; waters the Supar and Kahiri tapas
12.	Gulab Sial	1	-	Branch of the Indus; waters the Mundar tapa

13.	Ghari	6	8	Rises in the Sial Dhandh near Dadu; waters the tapas of Mundar and Khachar
14.	Wadhu	8	6	Rises close to the Ghari, flows through the same tapas above
15.	Phito	20	17	Taps the Indus near Chanrat, flows through Bhan between taluka Talti and Arazi into Sehwan, falling into the Aral at Sehwan
16.	Dangi Wah	3	7	Branch of the Phito; waters the Arazi tapa
17.	Shah Wah	3000 ft	4	Rises from the Morojo Mok, a tributary of Makaki canal
18.	Khan Wah	1000 ft	7	Taps the Indus and waters the Talti tapa
19.	Kolab Patoro	1 mile	-	
20.	Sabharo	1000 ft	19	Taps the Indus and waters the Talti tapa
21.	Aral	12 miles	150	Flows westwards from the Indus at Sehwan into the Manchar lake, a distance of 12 miles
22.	Bacha	1	11	Taps the Indus and waters the Amri tapa
23.	Gidan	2	11	Taps the Indus and waters the Amri tapa
24.	Mahesar	2	7	Taps the Indus and waters the Amri tapa
25.	Karo	16	8	Taps Indus near Sann and flows through the Sann, Manjhand and Noorpur tapas
26.	Shah Panjo	3	14	Taps the Indus near Noorpur. Flows through the Noorpur and Manjhand Tapas.
27.	Noorpur Batho	2	12	Taps Indus near Noorpur, and waters the Noorpur Tapa.
28.	Baghdad Wah	9	9	Taps the Indus near Khanot, and waters the Bhian Tapa.
29.	Kassi Bhan	1	6	Taps the Indus, and flows through the Mian Tapa.
30	Raj Wah	3	8	This is the mouth of the Sada Bahar; waters the Bhian Tapa.
31.	Sada Bahar	12	12	Taps the Indus near Budhapur, and flows through the Bhian and Bada tapas.
32.	Gharo	1	6	Taps the Indus, and waters the Bhian Tapa.
33.	Chhandan	2	6	Branch of the Gharo; waters the Bhian Tapa.
34.	Vachero	3	7	Branch of the Chhandan; waters the Bhian Tapa.
35.	Lungi	2	10	Taps the Indus, and waters the Bada Tapa.
36.	Railo	1	9	Taps the Indus, and waters the Bada Tapa.
37.	Chaubandi	¼	9	Taps the Indus, and waters the Bada Tapa.
38.	Makaki	1	-	Leaves the Baid branch of the Nara, and flows on the boundary separating the Dadu and Sehwan Taluka.

SHAH BANDAR DEPUTY COLLECTORATE (1876)

S.No.	Name of Canal	Length in miles	Width at mouth in feet	Remarks
1.	Ganj Bahar	11	14	Main feeder; taps the Indus in the Bano Tapa, waters that and the Laikpur Tapas, tailing off at deh Thutti.
2.	Ali Bahar	7	11	Main feeder; taps the Indus in Bano Tapa, watering that and the Laikpur Tapas.
3.	Chaugazo	4	8	Main feeder; taps the Indus in Bano Tapa, watering that and the Laikpur Tapas.
4.	Chhagazo	6	8	Main feeder; taps the Indus in Bano Tapa, watering that and the Laikpur Tapas.
5.	Mir Wah	11	10	Main feeder; taps Indus near Bano and waters the Bano and Laikpur Tapas.
6.	Pinyari, Chhandan Shor and Great Gungro	73	-	Branch of the Indus; waters the Bano and Laikpur Tapas, tailing off in the Gungro.
7.	Shaikh	8	9	Branch of the Pinyari.
8.	Mahmud Wah	15	40	Branch of the Pinyari.
9.	Sonahri	7	10	Branch of the Pinyari.
10.	Ganj Bahar	4	9	Branch of the Pinyari.
11.	Said Wah	5	6	Branch of the Pinyari.
12.	Shah Wah	7	16	Branch of the Pinyari.
13.	Chhandan	6	8	Branch of the Pinyari.
14.	Bhagiar	6	8	Branch of the Pinyari.
15.	Haider Wah	2	16	Branch of the Mahmud Wah.
16.	Ghari	11	10	Branch of the Haider Wah.
17.	Fatiha	8	7	Branch of the Haider Wah.
18.	Bachao	1	6	Branch of the Haider Wah.
19.	Chagla	1	6	Branch of the Bachao.
20.	Bhaghar	-	-	Branch of the Chagla.
21.	Char	3	6	Branch of the Mahmud Wah.
22.	Bachu	2	5	Branch of the Mahmud Wah.
23.	Syed Wah (geat)	6	12	Branch of the Chhandan.
24.	Tapau	2	7	Branch of the Pinyari.
25.	Ladhia	3	8	Branch of the Pinyari.
26.	Samaki	2	6	Branch of the Pinyari.
27.	Pal Leghari	3	6	Branch of the Pinyari.
28.	Ghari	11	18	Branch of the Pinyari.
29.	Raj Wah	2	7	Branch of the Ghari.

30.	Shor Wah	3	-	Branch of the Pinyari.
31.	Achu Dhandh	3	-	Branch of the Pinyari.
32.	Said Wah(less)	3	8	Branch of the Chhandan.
33.	Chhandan (new)	2	12	Branch of the Chhandan.
34.	Chejah	4	-	Branch of the Chhandan.
35.	Gungri	7	-	An old branch of the Indus, now supplied from the Pinyari.
36.	Gungro Ghar	5	9	Branch of the Gungro.
37.	Raharo	6	8	
38.	Malia	8	10	Branch of the Great Gungro.
39.	Mir Khanah	7	12	Branch of the Great Gungro.
40.	Manaki	2	8	Branch of the Great Gungro.
41.	Dirna	3	8	Branch of the Great Gungro.
42.	Mori Mula Balina	3	8	Branch of the Great Gungro.
43.	Raj Wah	1	11	Branch of the Great Gungro.
44.	Runja	4	9	Branch of the Raj Wah.
45.	Kochar Balina	4	6	Branch of the Raj Wah.
46.	Ochar Kiru Thahim	1	8	Branch of the Raj Wah.
47.	Rann Mula	2	6	Branch of the Great Gungro.
48.	Chabuk	1	-	Branch of the Great Gungro.
49.	Kirsar	2	6	Branch of the Great Gungro.
50.	Beguna	8	11	Branch of the Great Gungro.
51.	Chach Nooru Memon	-	-	Branch of the Great Gungro.
52.	Jharara	2	5	
53.	Gadap	18	13	Branch of the Great Gungro.
54.	Puhchari	3	5	Branch of the Gadap.
55.	Sari	3	5	Main feeder; taps Indus in Bano Tapa, and waters that and the Laikpur Tapas, tailing off at deh Khanpur.
56.	Veki	2	6	Branch of the Gadap.
57.	Sher Khan	10	20	Branch of the Great Gungro.
58.	Khati	2	-	Branch of the Sher Khan.
59.	Patheri	2	5	Branch of the Sher Khan.
60.	Chhandan	8	7	Branch of the Sher Khan.
61.	Ghat	2	5	Branch of the Sher Khan.
62.	Dorah	Thar	2	Branch of the Sher Khan.
63.	Chaubati	4	6	Branch of the Sher Khan.
64.	Kajri Dhandh	3	-	Branch of the Chhandan and Chaubati.

65.	Dabi	2	-	Branch of the Great Gungro.
66.	Ladka	5	10	Branch of the Great Gungro.
67.	Yasri	2	-	Branch of the Great Gungro.
68.	Jim Wah	9	-	Branch of the Great Gungro.
69.	Chang	1	-	Branch of the Jim Wah.
70.	Hajiya	11	-	Branch of the Great Gungro.
71.	Andorah	1	-	Branch of the Hajya
72.	Ghar Darsunar	1	-	Branch of the Hajya.
73.	Mori Kutka	1	-	Branch of the Great Gungro.
74.	Tangu	2	9	Branch of the Mori Kutka.
75.	Syed Wah	2	9	Branch of the Great Gungro.
76.	Chhandan Nawab	2	13	Branch of the Great Gungro.
77.	Mulchand	17	22	Main feeder; taps the Indus in the Bano Tapa, watering that and the Mirpur Bathoro Tapas.
78.	Bathoro	7	13	Branch of the Mulchand.
79.	Chor Wah	7	6	Branch of the Bathoro
80.	Jafra Kalan	7	7	Branch of the Bathoro.
81.	Baragazo	8	12	Main feeder; taps Indus in Bano Tapa, watering that and the Vital Shah Talukas Tapas tailing off in the latter.
82.	Panjgaza	2	-	Branch of the Baragazo.
83.	Shah Wah	6	8	Branch of the Baragazo.
84.	Bachi	1	-	Branch of the Mahmud Wah.
85.	Jarar	7	10	Main feeder; taps Indus in Bano Tapa, watering that and the Vital Shah Talukas Tapas tailing off in the latter.
86.	Chhandan	11	6	Main feeder; taps Indus at Khadi, and waters the Vital Shah Tapas.
87.	Raj Wah	3	12	Main feeder; taps Indus in Belo Tapa, watering the Vital Shah and Ranta Tapas.
88.	Kumbra	1	-	Main feeder; taps Indus in Ranta Tapa, above Kot Almo, and waters the Ranta Tapa.
89.	Chilati	1	-	Main feeder.
90.	Amb Wah	2	7	Main feeder; taps Indus in Ranta Tapa, which it waters.
91.	Char	2	6	Main feeder; taps Indus in Ranta Tapa, which it waters.
92.	Chhagazo	7	-	Main feeder; taps Indus near Bano, watering that Tapa.
93.	Kiral	1	-	Main feeder; taps Indus in Ranta Tapa, which it waters.
94.	Naiser Kalan	5	12	Main feeder; taps Indus in Ranta Tapa, which, and the Wali Shah Tapa, it waters.

95.	Hekra	1	8	Main feeder; taps Indus in Ranta Tapa which it waters.
96.	Kardar	2	-	Branch of the Hakra.
97.	Hekra	1	-	Branch of the Mahmud Wah.
98.	Ghar	2	6	Main feeder; taps Indus in Ranta Tapa, which it waters.
99.	Matla (great)	4	12	Main feeder; taps Indus in Ranta Tapa, which it waters.
100.	Matla (small)	1	5	Branch of the Great Matla.
101.	Daingan	2	-	Main feeder; taps Indus near Belo.
102.	Mir Samma	4	-	Main feeder; taps Indus near Belo.
103.	Mir Wah	6	12	Main feeder; taps Indus in Ranta Tapa, watering that and the Sujawal Tapas.
104.	Muhammad Wah	7	11	Main feeder; Taps Indus in Sujawal Tapa, which it waters.
105.	Taktaram	5	-	Main feeder; taps Indus near Sadipur, and water the Sujawal Tapa.
106.	106. Bosano Wah	5	11	Main feeder; taps Indus in Mirza Leghari Tapa, which it waters.
107.	Chhato (great)	9	11	Main feeder; taps Indus in Mirza Lehgari Tapa, which it waters.
108.	Chhato (small)	6	12	Main feeder; taps Indus in Mirza Leghari Tapa, which it waters.
109.	Mirza	7	11	Main feeder; taps Indus near Bhadipur, which tapas it waters.
110.	Sada (great)	4	12	Main feeder; taps Indus in the Bhadipur Tapa, which it waters.
111.	Satah	40	24	Main feeder; taps Indus at Got Jumo Sumro, watering the Gungani and Satah Tapas.
112.	Sada	2	7	Branch of the Satah.
113.	Charaki	3	6	Branch of the Satah.
114.	Sukhpur	3	6	Branch of the Satah.
115.	Raj Wah	5	10	Branch of the Satah.
116.	Hathima	4	5	Branch of the Satah.
117.	Ghar	22	13	Main feeder; taps Indus in the Bhadipur Tapa, watering that and the Shah Bandar Tapas.
118.	Khanto (large)	24	25	Main feeder; Tapa Indus in the Gungani Tapa, watering that and the Shah Bandar Tapas, and tailing off in the latter Tapa.
119.	Khilan	3	5	Branch of the Khanto.
120.	Nasir	3	6	Branch of the Khanto.
121.	Dhang Wah	4	7	Branch of the Khanto.
122.	Rahim	3	-	Branch of the Khanto.
123.	Ali Wah	4	8	Branch of the Khanto.

124.	Bhur Wah	7	8	Branch of the Khanto.
125.	Mir Kalan	6	8	Branch of the Khanto.
126.	Mir Wadho	2	-	Branch of the Khanto.
127.	Mir Khanto	2	7	Branch of the Khanto (large).
128.	Phatar	1	-	Branch of the Mir Khanto.
129.	Hasan Ali	4	6	Main feeder; Taps Indus near Gungani, watering that Tapa.
130.	Alahkahi	2	6	Main feeder; Taps Indus near Gungani, watering that Tapa.
131.	Pir Wah Gunani	3	-	Main feeder; Taps Indus near Gungani, watering that Tapa.
132.	Khanto (small)	2	7	Main feeder; Taps Indus near Gungani, watering that Tapa.
133.	Achh	2	-	Main feeder; Taps Indus near Gungani, watering that Tapa.
134.	Jhor Wah	2	8	Main feeder; taps Indus in Jalbani Tapa, which it waters.
135.	Pang Patan	1	-	Branch of the Jhor Wah.
136.	Pir Wah (new)	2	6	Main feeder; taps Indus in Jalbani Tapa, which it waters.
137.	Mori Shora	2	6	Main feeder; taps Indus in Jalbani Tapa, which it waters.
138.	Tingaza Jiand	2	6	Main feeder; taps Indus above Panjgazo, watering the Jalbani Tapa.
139.	Panjgaza Kalan	4	16	Main feeder; taps Indus in Shah Bandar Tapa, which it waters.
140.	Kodhario	5	10	Branch of the Panjgazo.
141.	Tingaza	1	7	Branch of the Panjgazo.
142.	Siplad	2	6	Branch of the Panjgazo.
143.	Harund	2	-	Branch of the Panjgazo.
144.	Paj Wah	4	7	Branch of the Panjgazo.
145.	Chaugazo	3	7	Main feeder; taps Indus in Shah Bandar Tapa, which it waters.
146.	River Mal	24	-	Main feeder; taps Indus near Bagana, watering the Shah Bandar and Mutni Tapas.
147.	Siarbet	1	6	Branch of the Mal River.
148.	Kadaran	3	6	Branch of the Mal River.
149.	Khair	11	-	Branch of the Mal River.
150.	Tailing (old)	4	-	Main feeder; taps Indus near Mutni, watering the Mutni Tapa.
151.	Musa	3	-	Main feeder; taps Indus near Mutni, watering the Mutni Tapa.
152.	River	17	-	Taps Indus near Mutni, watering the Mutni Tapa.

LIST OF THE GOVERNMENT CANALS IN SHIKARPUR DIVISION WITH THE OTHER INFORMATION WITH THEM (1876)

S.No.	Name of Canal	Length in miles	Width & mouth in feet	Remarks
1.	Sindh	37	60	Has three mouths leading out from the Kot Shahu Dhandh, and flows from the village of Shahpur, between the Sukkur and Shikarpur Talukas.
2.	Begari (large)	…	…	This canal is under the management of the Frontier (Jacobabad) district authorities (for information respecting it see under Frontier district).
3.	Begari (small)	6	12	Is a branch of the Sindh Wah and waters the southern part of the Shikarpur Taluka.
4.	Rais Wah	6	14	Is a branch of the Sindh Wah and waters the southern part of the Shikarpur Taluka.
5.	Ali Bahar	24	22	Water the Naushehro Abro Taluka.
6.	Fazal Bahar	4	24	Waters the Naushehro Abro Taluka.
7.	Ghar	6	60	Is a very large canal, but only 6 miles of it are in this division. It more properly belongs to the Larkana district.
8.	Sukkur	76	24	Main feeders; flows through the Sukkur and Naushehro Abro Talukas for about 39 miles.

ZAMINDARI CANALS IN SHIKARPUR DIVISION

S.No.	Name of Canal	Length in miles	Width of mouth in feet	Remarks
1.	Mirza Wah	8	16	Issues from the Sindh Wah Shikarpur Taluka has been useless for some years, owing to the Muhromari flood.
2.	Mir Wah	12	34	Issues from Naushahro Abro Taluka this on the Mungar Wah from the tail to the Sindh Wah. Has a sluice bridge.
3.	Mungar Wah	19	25	Issues from Naushahro Abro Taluka branches off from the Sindh at the village of Kot Habib. Has a sluice bridge.
4.	Chiti Wah	4	45	Issues from Gurang (or Mushah) Sukkur Taluka.
5.	Rajit Wah	5	41	Issues from Gurang (or Mushah) Sukkur Taluka, flows near the villages of Raban and Garhi Adu Shah.
6.	Garang Wah	13	32	Issues from Mushah Wah or Garang Sukkur Taluka has two sluice bridges; tail was cut off by the Sukkur Canal.
7.	Askar Wah	5	16	Issues from Rajit Wah Sukkur Taluka the village of Chak is on this canal.
8.	Gath Wah	6	10	Issues from Chiti Wah Sukkur Taluka.
9.	Shor Wah	4	5	Issues from Shikarpur Taluka is the northern bank of the Shoro Wah Dhandh, raised and widened.
10.	Faiz Wah	12	7	Issues from Large Begari Shikarpur Taluka.
11.	Guwaz Wah	4	10	Issues from Large Begari Shikarpur Taluka.
12.	Dost Wah	13	12	Issues from Large Begari Shikarpur Taluka.
13.	Hamayun Wah	6	9	Issues from Large Begari Shikarpur Taluka.
14.	Jagan Wah	9	12	Issues from Large Begari Shikarpur Taluka.
15.	Yasin Wah	8	22	Issues from Sindh Wah Naushehro Abro Taluka.
16.	Rahim Wah	15	25	Issues from Large Begari Shikarpur Taluka.

TANDA (TANDO MUHAMMAD KHAN) DEPUTY COLLECTORATE (1876)

S.No.	Name of Canal	Length in miles	Width at mouth in feet	Remarks
1.	Guni	69	122	Continuation of the Phuleli, and rises from the Indus; is navigable, and divides the Guni and Badin Talukas form the Dero Mohbat and Bago Tanda Talukas.
2.	Phuleli (old)	6	18	Now the mouth of the Gajah, is navigable.
3.	Dodo	3 ¾	6	Branch of the Guni, waters the Saidpur Tapa.
4.	Dhadh Wah	21 ¼	14	Branch of the Guni; waters Gul Muhammad Zor Tapa.
5.	Maluk Wah	7 ¾	7	Branch of the Dhadh Wah; waters Gul Muhammad Zor Tapa.
6.	Khan Wah	4 ¾	6	Branch of the Dhadh Wah; waters Gul Muhammad Zor Tapa.
7.	Sher Wah	7 ¼	9	Branch of the Dhadh Wah; waters Gul Muhammad Zor Tapa.
8.	Ghari	4 ¾	7	Branch of the Dhadh Wah; waters Gul Muhammad Zor Tapa.
9.	Panjtana Wah	9	8	Branch of the Ali Bahar; waters Ghulam Haider Tapa.
10.	Ali Bahar	16	26	Branch of the Guni; partly navigable, waters Haji Sawan and Gul Muhammad Zor Tapas.
11.	Pir Wah	16 ¼	16	Branch of the Guni; partly navigable, waters Haji Swan and Gul Muhammad Zor Tapas.
12.	Mubarak Wah	10	11	Branch of the Guni; waters the Ghulam Haider Tapa.
13.	Buhawali	3	6	Branch of the Guni; waters the Ghulam Haider Tapa.
14.	Jagsi	3 ½	11	Branch of the Guni; waters the Ghulam Haider Tapa.
15.	Shah Wah	19	13	Branch of the Guni; waters Ghulam Haider Jusa Jakhro Tapas.
16.	Imam Wah	42 ½	24	Branch of the Guni; navigable 20 miles; waters Haji Sawan, Gul Muhammad Zor, Sarmat Leghari, Karam Khan Jamali, and Dodoh Tapas.
17.	Dokiah	12 ¾	14	Branch of the Guni; un-navigable; waters Juma Jakhro and Talukahar Tapas.
18.	Mahrab	4 ¾	6	Branch of Guni; waters the Haji Sawan Tapa.
19.	Chhandan	3	6	Branch of Guni; waters the Haji Sawan Tapa.
20.	Jamahero	4 ¾	9	Branch of the Guni; waters Khado Tapa.
21.	Sher Wah Kobri	3	7	Branch of the Guni; partly navigable; waters the Karam Khan Jamali, Dadah, Haji Sawan, and Sarmat Leghari Tapas.
22.	Mulchand	20 ½	25	Branch of the Guni; partly navigable; waters the Karam Khan Jamali, Dadah, Haji Sawan, and Sarmat Leghari Tapas.
23.	Imam Wah	2 ½	6	Branch of the Guni; waters Karam Khan Jamali Tapa.
24.	Fazlullah	3 ¼	6	Branch of the Guni; waters Karam Khan Jamali Tapa.
25.	Mir Wah (Talukahar)	21 ½	22	Branch of the Guni; navigable whole length; waters Talukahar Khado, Badin, Juma Jakhro, and Ghulam Haider Tapas.
26.	Raj Wah	5	10	Branch of the Mir Wah; waters Khado Talukahar Tapas.

27.	Ghari Mand-har	28 ¾	18	Branch of the Mir Wah; partly navigable; waters auri, Sirani, and Badin Tapas.
28.	Nasir Wah	30 ¾	32	Branch of the Guni; wholly navigable; waters the Susro Ka-loi, Karam Khan Jamali, Khairpur and Dadah Tapas.
29.	Nanak Wah	13 ½	34	Branch of the Guni; navigable, waters Surro Kalio Tapa.
30.	Lundo	6	11	Branch of the Manak Wah; water Surro Kaloi Khairpur Tapas.
31.	Ashwan Wah	9	11	Branch of the Manak Wah; water Surro Kaloi Khairpur Tapas.
32.	Mir Wah	16	16	Branch of the Ranak Wah; partly navigable; waters the Pan-grio, Khairpur and Kaloi Tapas.
33.	Shadi (large)	13 ¾	30	Branch of the Guni; wholly navigable; waters Tapas as above.
34.	Banadur	7 ¾	30	Branch of the Shadi; waters the Pangrio Tapa.
35.	Bag Wah	12 ½	15	Branch of the Shadi, partly navigable; waters Khairpur and Pangrio Tapas.
36.	Shadi (small)	16	15	Branch of the Shadi; waters the Pangrio Tapa.
37.	Sada	7 ½	8	Branch of Guni; waters the Khado Tapa.
38.	Kaziah	29 ¾	24	Branch of the Guni; wholly navigable; waters the Badin, Khado, Launi, and Bahdimi Tapas.
39.	Noor Wah	10	10	Branch of the Kaziah; waters the Bahdimi Tapa.
40.	Ganj Bahar	7 ½	9	Branch of the Kaziah; waters the Bahdimi Tapa.
41.	Ali Bahar	19 ¼	13	Branch of the Guni; partly navigable; waters the Wango and Pangrio Tapas.
42.	Ghar-Lauri	4 ¾	12	Branch of the Guni; waters Nindo Shahar and Lauri Tapas.
43.	Ali Wah	7	8	Branch of the Ghar-Lauri; waters the Lauri Tapa.
44.	Lakhiah	4 ¾	6	Branch of the Ghar-Lauri; waters the Lauri Tapa.
45.	Mahrab	5 ¼	6	Branch of the Ghar-Lauri; waters the Lauri Tapa.
46.	Ghar Kadhan	6 ½	10	Branch of the Guni; waters Nindo Shahar and Lauri Tapa.
47.	Raj Wah	8	8	Branch of the Ghar; Radhan; waters Radhan and Lauri Tapas.
48.	Wangi	10 ½	12	Branch of the Guni; waters Wango and Nindo Shahar Tapas.
49.	Sanhi Guni	11	14	Branch of the Guni; partly navigable; waters Nindo Shahar and Radhan Tapas.
50.	Sher Wah	5 ½	10	Branch of the Sanhi; waters Nindo Shahar Tapa.
51.	Mir Wah	7	6	Branch of the Sanhi; waters Nindo Shahar, Radhan, and Tapas.
52.	Sher Wah	23 ¾	16	Branch of the Guni; partly navigable; waters Nindo Shahar and Wango Tapas.
53.	Ali Wah	22	16	Branch of the Guni; partly navigable; waters Nindo Shahar and Radhan Tapas.
54.	Gajah	45	18	Continuation on the old Phuleli; wholly navigable; waters the Katyar, Ghulam Haider, Bulri, Agri and Khor Wah Tapas.
55.	Jam Wah	14	8	Branch of the Gajah; waters the Ghulam Haider and Agri Tapas.
56.	Panjtansh	4	9	Branch of the Gajah; waters the Bulri Tapa.

57.	Rah Wah	6 ¼	12	Branch of the Gajah; waters the Agri Tapa.
58.	Manak Wah	6	8	Branch of the Gajah; waters the Agri Tapa.
59	Saidah	2	14	
60.	Mir Wah Duk	10 ¾	8	Branch of the Saidah; waters the Agri and Khor Wah Tapas.
61.	Khor Wah	4 ¾	8	Branch of the Gaja; waters the Khor Wah Tapa.
62.	Chautaki	3	5	Branch of the Khor Wah; waters the Khor Wah Tapa.
63.	Sher Wah	8	11	Tail of the Gajah; waters the Khor Wah Tapa.
64.	Banadur	4	6	Branch of the Sher Wah; waters the Khor Wah Tapa.
65.	Pairzo Wah	4	8	Branch of the Sher Wah; waters the Khor Wah Tapa.
66.	Mir Wah	3	8	Main feeder from the Indus; waters the Guni Taluka.
67.	Waseeng Wah	4 ½	8	Main feeder from the Indus; waters Khairpur and Katyar Tapas.
68.	Noor Wah	5	11	Main feeder from the Indus; waters the Katyar Tapa.
69.	Hasanali Wah	13	13	Main feeder from the Indus; waters the Khokhar and Dhandhi Tapas.
70.	Kahir Wah	14	16	Main feeder from the Indus; waters the Khokhar and Dhandhi Tapas.
71.	Khokhar Wah	5 ½	12	Main feeder from the Indus waters the Ratyab and Khokhar Tapas.
72.	Dhadhko	10	12	Main feeder from the Indus; waters the Ratyar and Khokhar Tapas.
73.	Bhaghair	6	9	Main feeder from the Indus; waters Dhandhi Tapa.
74.	Mulchand	17	22	Main feeder from the Indus; partly navigable; waters the Dhandhi Tapa.
75.	Mir Wah (old)	8	6	Branch of the Mulchand; waters Dhandhi and Bulri Tapas.
76.	Mir Wah (new)	7 ½	10	Branch of the Mulchand; waters Dhandhi and Bulri Tapas.
77.	Ditah	5	9	Branch of the Mulchand; waters Dhandhi and Bulri Tapas.
78.	Kabrah	3	6	Branch of the Ditah; waters the Bulri Tapa.
79.	Nasir Wah	3 ½	9	Branch of the Mulchand; waters the Dhandhi and Bulri Tapas.
80.	Kabulah	3 ¾	6	Branch of the Nasir Wah; waters Bulri Tapa.
81.	Sajan	8 ½	8	Branch of the Nasir Wah; waters the Dhandhi and Bulri Tapas.
82.	Joyah	8 ¾	10	Branch of the Mulchand; waters Khor Wah Tapa.
83.	Sarfaraz Wah	36	18	Main feeder from Indus; waters Gul Muhammad Zor and Gujo Tapas of Dero Mohabat Taluka; tail only of this canal is in this district.
84.	Lundo Bagmal	9	15	Branch of the Sarfaraz Wah; waters the Gujo Tapa.
85.	Chaugazo Gujo	7 ¾	8	Branch of the Sarfaraz Wah; waters the Gujo Tapa.
86.	Chaugazo Garho	5 ¼	8	Branch of the Sarfaraz Wah; waters the Gujo, and Sarmat Leghari Tapas.

87.	Murid Wah	8	12	Branch of the Sarfaraz Wah; waters the Gujo Tapa.
88.	Nangnai	9 ½	8	Branch of the Ghalu Wah; is the tail only; waters the Gujo Tapa.
89.	Murid Wah	5	6	Branch of the Nangnai; is the tail only; waters the Gujo Tapa.

JAGIRDARI CANALS IN TANDA DIVISION

S.No.	Canal	Length in miles	Width at mouth in feet	Remarks
1.	Imam Wah	40	20	Issues from Guni Taluka in the Jagir of Mir Ghulam Shah Shahwani.
2.	Ali Bahar	7 ¾	13	Issues from Guni Taluka.
3.	Pandia Wah	6	12	Issues from Guni Taluka.
4.	Lundo	5	14	Issues from Guni Taluka in the Jagir of Nabi Bakhsh Mari.
5.	Hadachar	6	16	Issues from Guni Tando Bagho Taluka in the Jagir of Mir Ghulam Hussain Shahdadani.
6.	Ghar Sharakat	5	14	Issues from Guni Tando Bagho Taluka.
7.	Jhur Wah	4	12	Issues from Mulchand Tando Bagho Taluka in the Jagir of Mir Wali Muhammad Bagani.

LIST OF CANALS IN THE NARA DISTRICT (1876)

S.No.	Name of Canal	Length in miles	Width at mouth in feet	Remarks
1.	Mithrao	123	56	Rises in the Makhi Dhandh, and flows through the Sanghar, Khipro and Umarkot Talukas.
2.	Dim Wah	15	24	Branch of the Nara; waters the Sanghar Taluka.
3.	Heran Wah	2 ¼	6	Branch of the Nara; waters the Sanghar Taluka.
4.	Shahdad Wah (small)	2 ¾	8	Branch of the Shahdad Wah (large).
5.	Shahdad Wah (large)	1	8	Takes off from the Shah Wah, a canal in the Hyderabad collectorate.
6.	Khair Wah	4	8	Branch of the Shah Dad Wah (large).
7.	Thar	24	34	The Thar takes off from the Eastern Nara, and the other two canals are branches.
8.	Umarkot (Branch)	10	32	
9.	Chor (Branch)	10	13	
10.	Silor Wah	10 ½	22	Branch of the Nasir Wah; a canal in the Hyderabad collectorate.
11.	Chaugazah	4 ½	12	Branch of the Bagi Wah.
12.	Bagi Wah	6 ¾	22	Branch of the Naiser Wah canal.
13.	Puran	40	-	Presumed to be the bed of some ancient river. Several of the Hyderabad collectorate canals, such as the Ali Wah, Ali Bahar, and Nasir Wah, tails off into the Puran.

APPENDIX II

THE CITIES AND SETTLEMENTS IN SINDH; THEIR RISE AND DECLINE WITH CHANGES IN THE COURSES OF THE INDUS RIVER SYSTEM

It was invention of agriculture that led to the settled life, villages, roads and trade. Agriculture got a big boost up with introduction of irrigation and led to development of cities, new methods of transport and inter-city and international trade. History of the irrigation is thus directly related to history of settlements. If the River Indus changed its course, it made enormous changes in settlements, roads, trade and migrations. The major changes in cities and settlements are discussed here starting with 6500 BC to the present times.

The Indus Rriver system consists, not only of its seven tributaries Swat, Kabul, Jhelum, Chenab, Ravi, Beas and Sutlej, but also less known tributaries from hills to its west and other rivers of Luni Basin, draining from the Aravalis.

The influence of the rain fed rivers of the western hills of Sindh (Kohistan) is perceptible even today. Each year they bring storm or flash floods, eroding hills and carrying huge quantities of silt deposits to the plains. The piedmont soils in the western Sindh are the sole contribution of streams, which are more than three dozens in number. The major ones of these in the northern Sindh are Mula, Mazarani, Sita and Gaj, supplemented by Bolan of Balochistan. One time the Bolan discharged into the Indus, via the Manchar Lake, south-east of present town of Sehwan. The other streams then were tributaries of the Bolan. Some 9,000 to 4,000 years ago, they had formed a perennial channel. Due to silt deposited by these western tributaries, this channel kept east-warding or eastering. The channel also could have discharged into the Indus itself, much above Sehwan, but for a perennial western branch of the Indus, which carried much larger quantities of water, excepting during the peak days of thunder storm. This western branch of the Indus, kept some distance away from the main channel of the Indus. In the process of the drainage they formed series of depressions, along a well defined route, known as the Sindh Hollow. Depressions below Garhi Khairo and Shahdad Kot, and Hamal and Manchar lakes are but a creation of this drainage.

Below Sehwan the major tributaries of the western hills are the Sann, the Baran, the Kalu and the Jungshahi. Although they are non-perennial but they bring a peak discharge of over 100,000 cusecs in frequent years and discharge into the Indus. Their violent action of discharging into the Indus can be perceived from the following facts.

- The town of Sann stands on the western berm of the Indus, but town has survived the erosion action of the Indus for many hundreds of years. It cannot go west-ward even by a few feet as the Sann River discharging near Sann in the river Indus erodes its opposite bank, pushing its waters away. When it discharges, the grey waters of the Indus are visible only at the eastern bank and the western bank has brown water of the Sann River.
- Almost similar is the action of the Baran on the Indus near Onager and thanks to Baran, the town of Jherruck has survived the erosion of the Indus for 2,000 years.
- Rain fed streams Rode and Kalu are responsible for maintaining Keenjhar Lake, which depression they eroded before entering the Indus.
- Jungshahi stream did the same and created depressions of Kalri and Haleji lakes.

The story of Luni and other streams of east is also not less dramatic. They formed the present eastern desert of Sindh, known as Thar, a part of the Great Indian Desert, during geological times. Drishadvati- Sarsuiti system, during the early Pleistocene discharged into Luni. It started

discharging in present Hakra River near Umarkot during middle Pleistocene and during late Pleistocene in Makhi-Farash-Chotiari system of lakes, and thence via present Hakra to the sea. Some 10,000 years ago it started the latest of its courses through Bikanir and Bahawalpur to Sukkur district, then via present Rainee and Hakra or Eastern Nara to Koree Creek. With the Indian Desert to the east and Sindh's Kohistan to the west, the central part of Sindh was left to the Indus to meander. The Indus on entering Sindh usually shot up a western branch as aforesaid and usually had no eastern branches in the northern Sindh, except at least 5,000 years to 1,000 years ago, when it shot up an eastern branch which passed through Alore gorge to follow the alignment along the eastern Mir Wah to Kot Dijji, and then south.

Its central and main stream always flowed to the west of Sukkur and then bent to cross the present channel in Khairpur district and usually flowed some 10-15 miles east of the present course. Below present line running east to west of Sakrand, the Indus started its delta-head and usually shot up two or three deltaic branches. Near the coast each of them again shot up two or more branches. For all the past centuries the number of major deltaic branches discharging into the sea near the coast was five to eight.

Since slopes in the Indus plains are about eight inches to a mile, at this slope the velocity of water is so low that the river starts depositing silt, brought from the Punjab and NWFP, where it erodes due to much higher slopes of ground and hills. Silting raises the bed of river over surrounding country and then it breaches to form a new course. Courses are un-stable, but if the river is able to cut a gorge, it usually becomes fixed there for many centuries. The well known gorges of the Indus in Sindh are:

- The **Alore Gorge,** wherefrom the Indus flowed at least during 5,000-1,000 years ago.
- The **Bakhar Gorge,** through which Indus is flowing since about the past 1,000 years.
- The **Kotri-Hyderabad Gorge,** through which the Indus is flowing since 1758 AD.
- The **Samui Gorge,** between Jungshahi and Makli hills. The river abandoned it between 1333 and 1350 AD.
- The **Banbhore Gorge,** through Banbhore town and hillock on the opposite side under the Harjinia salt mines. This gorge existed between 325 BC and 1228 AD, and may have been abandoned by the river around 1300 AD.
- The **Pir Patho Gorge,** which took waters of Baghar branch of the Indus, time and again, since 1000 AD, and was comparatively un-important.
- The **Aral Canal Gorge**, which discharged water of the western branch of the Indus, Manchar and hill streams. It has been given a new mouth through a permanent gorge between Sehwan and Bhagothoro hills.

Gorges fix the river or its branches, for centuries and permanent settlements start at these points. In addition to the settlements, in the arid areas, at the points of permanent supply of water, rise centres of water worship, resulting into holiness of the places.

HUMAN SETTLEMENTS IN STONE AGE

Rohri hills have a thirty-two acre Stone Age tool factory. One class of tools goes back to 500,000 years before present, but there are many categorized as the late Stone Age tools (35,000 to 10,000 BC) and Microlithic tools (10,000-2,500 BC) found at the site.

Tools of this era are also found at Ubhan Shah, Shahanshah Baloch village and Unar farm near Kot Dijji in Kot Dijji hills.

A peculiar class of tools, also containing fishing tools, are also found on a hill-top about twenty-five miles from Hyderabad on Hyderabad-Thatta road. Some of tools at all these sites are also Microlithic, evolved after 10,000 BC and used until introduction of copper tools during the Indus Culture Times.

HUMAN SETTLEMENTS IN SINDH DURING 6,500 TO 3,500 BC

Permanent settlements started with introduction of agriculture on Bolan River at Mehrgarh, 10 miles south-west of Sibi around 6,500 BC. The Bolan River then passed through the Sindh Hollow to Manchar Lake and then via the Aral to the River Indus. The Ancient course of the Bolan to Manchar shows series of sites, which though have not been excavated, but indicate human settlement in this era. The sites extend to Sindh.

HUMAN SETTLEMENTS DURING 3,500 TO 3,000 BC OR AMRIAN OR THE EARLY INDUS CULTURE TIMES

Amri is an important settlement on the Aral branch, draining water of the western hills from the Manchar Lake to the River Indus. Its contemporary sites

are along the Bolan-Manchar drainage at Ali Murad, Tando Rahim Khan, Ghazi Shah and Shah Hassan.

The Manchar Lake, itself a hunter's paradise, was exploited by the man much earlier, not only for some 200 varieties of fish, but also for more than twelve migratory birds, which came in each winter from Siberia and other lakes Russia.

SETTLEMENTS IN SINDH SHOWN IN PTOLEMY'S MAP (150 AD) AND THERE POSSIBLE NAMES FROM HIS LATITUDES AND LONGITUDES

Ptolemy's names	Possible names today
Asigramma	Uch
Pasipeda	Sehwan
Parise	Kohistan of Sindh
Oscana	Oxykanus (Mahota)
Musarna	Musikana (country of Musicanus)
Binagara	Alore
Kemigara	River north of Alore
Kalaka	Krokala (Ubhan Shah?)
Baribari	Barbarican (Banbhore) and Debal from 300 AD to date
Aurinda	Vinjrot
Pisca	Buddhist stupa at Dhamraho
Patalene	Indus delta
Arbita	Khirthar range or Kohistan
Sirastrene	The Gulf of Sindh (present Rann of Kutch)
Indo-Scythia	Sindh (up to Multan)
Patala	Brahmanabad
River south of Pasipeda	Aral

IMPORTANT SETTLEMENTS DURING 3,000-2,300 BC

An important settlement *Kot Dijji* was on the branch of the Indus, passing the Alore gorge.

MATURE INDUS SITES SETTLEMENTS (2,300- 1,650 BC)

These are represented by Mohenjo Daro and are categorized as mature Indus culture sites, being present at the following places, on the branches of the Indus:

- **Junirjo Daro;** on Bolan-Manchar drainage in Balochistan and Limo Junejo Daro; on the western branch of the Indus.
- **Vinjrot;** on Drishadvati-Sarsuiti-Hakra system of rivers.
- **Mohenjo Daro and Lohamjo Daro;** in the northern Sindh, on the main branch of the river Indus.
- **Pandhi Wahi, Ali Murad, Tando Rahim Khan, Ghazi Shah, Shah Hassan, Sehwan and Amri**; on Bolan-Manchar-Aral drainage system.
- **Kot Dijji;** on branch of Indus passing through the Alore gorge.
- **Pokhan, Taung, Khajur, Shahjo Kotrio, Kohtarash, Arabjo Thano, Osman Buthi, Jhangari, Bachani and Disoi;** on the Baran, a tributary of the Indus.
- **Nohoto;** on Drishadvati-Sarsuiti-Hakra system.

A number of un-surveyed sites along the Rainee-Hakra-Drishadvati-Sarsuiti system in Sukkur and Khairpur districts.

SETTLEMENTS DURING DECLINING INDUS CULTURE

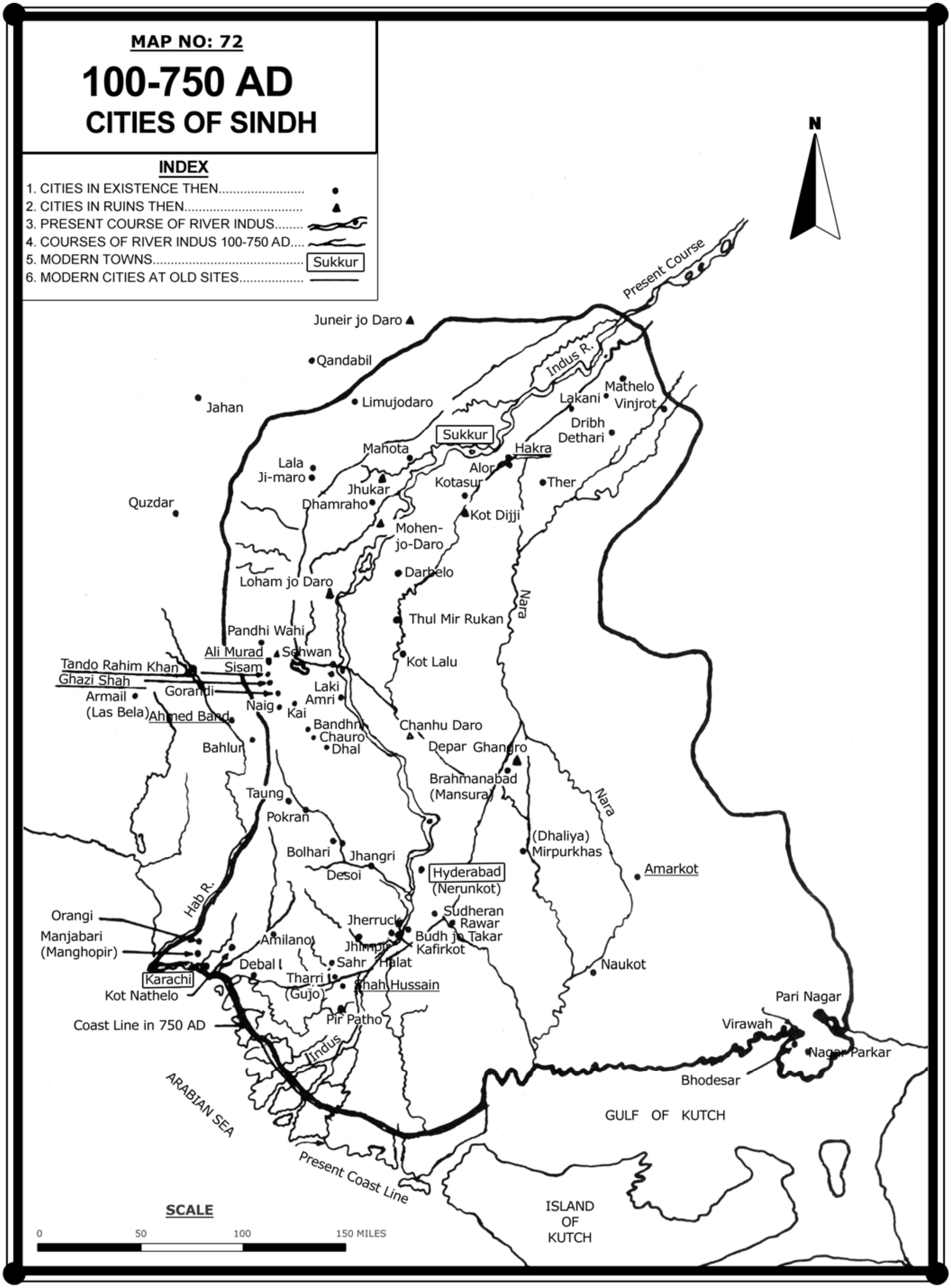
- **Jhukar** on the Indus.
- **Jhangar** on the Manchar Lake.

SETTLEMENTS IN SINDH DURING 500 BC TO 200 BC

- **Alore;** on Alore gorge on the eastern branch of the Indus, and capital of Musicanus.
- **Mahota;** on the main branch of the Indus.
- **Patala** (Brahmanabad) mentioned as Brahmanka in Panini's grammar of Sanskrit language, written around 450-400 BC; stood on the eastern branch of the Indus.
- **Sukkur;** on the main branch of the Indus, known as Sarkara to Panini.
- **Alexander's Haven** (Banbhore or Barbarican); on the western deltaic branch of the Indus.
- **Sehwan;** on Aral branch of Bolan-Manchar-Aral drainage.

SETTLEMENTS IN SINDH DURING 200 BC TO 100 AD

- **Alore**; on the Alore gorge of eastern branch of the Indus.
- **Sadusan** (Sehwan); on the Aral branch of the


MAP NO: 72
100-750 AD
CITIES OF SINDH
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2. CITIES IN RUINS THEN
3. PRESENT COURSE OF RIVER INDUS
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Sukkur
6. MODERN CITIES AT OLD SITES
N
Present Course
Juneir jo Daro
Qandabil
Jahan
Limujodaro
Indus R.
Mathelo
Lakani
Vinjrot
Dribh
Dethari
Sukkur
Mahota
Hakra
Lala
Ji-maro
Alor
Kotasur
Ther
Jhukar
Dhamraho
Quzdar
Kot Dijji
Mohen-
jo-Daro
Darbelo
Loham jo Daro
Nara
Thul Mir Rukan
Pandhi Wahi
Ali Murad
Sehwan
Kot Lalu
Tando Rahim Khan
Sisam
Ghazi Shah
Gorandi
Laki
Armail
Amri
(Las Bela)
Naig
Kai
Ahmed Band
Bandhni
Chanhu Daro
Chauro
Bahlur
Dhal
Depar
Ghangro
Brahmanabad
(Mansura)
Nara
Taung
Pokran
(Dhaliya)
Mirpurkhas
Bolhari
Jhangri
Desoi
Hyderabad
(Nerunkot)
Amarkot
Hab R.
Orangi
Sudheran
Jherruck
Rawar
Manjabari
(Manghopir)
Amilano
Jhimpir
Budh jo Takar
Kafirkot
Debal
Sahr
Halat
Naukot
Karachi
Tharri
(Gujo)
Shah Hussain
Kot Nathelo
Pari Nagar
Coast Line in 750 AD
Pir Patho
Virawah
Indus
Nagar Parkar
Bhodesar
ARABIAN SEA
GULF OF KUTCH
Present Coast Line
ISLAND
OF
KUTCH
SCALE
0
50
100
150 MILES

Indus.

- **Minnagara or Patala** or Binagara; on the deltaic eastern branch of the Indus.
- **Barbarican** (Banbhore); on deltaic western branch of the Indus.
- **Arabian Sea** was called Erythrean Sea then.
- **Rani Kot Fort** was built 35 miles west of the course of Indus, for protection against land and river invasions.

100 TO 750 AD, TOWNS ON THE WESTERN BRANCH OF THE INDUS AND BOLAN-MANCHAR-ARAL DRAINAGE

- Limo Daro, Lailaji Mari, Pandhi Wahi, Sisam (Shah Hassan), Tando Rahim, Ghazi Shah, Ali Murad, Sehwan, Dhamraho and Mahota.
- Towns on the eastern branch of the Indus, passing through Alore gorge, Likan, Mathelo, Hakara, Kadasur and Kot Dijji.
- Towns on the main branch of the Indus, Sakara (Sukkur), Darbelo, Thul Mir Rukan, Kot Lalu, Depar Ghanghro and Brahmanabad.
- Town on the deltaic eastern branch of the Indus or Eastern Puran, Dhaliya (Mirpurkhas).
- Towns on Hakra (on spill water from the Indus or Sutlej), Vinjrot, Ther, Amarkot and Naokot.
- Towns on the deltaic western branch of the Indus, Sudheranjo Daro, Rawar, Budhjo Takar, Kirr Kot, Shah Hassan Tharri Gujo, Pir Patho, Jherruck and Nerun (location of Nerun cannot be Hyderabad but some place 10 or 15 miles south, and above Tando Muhammad Khan, at the foot of Ganjo Takar hills on their southern edge). The river being more than sixteen miles east, water from it cannot reach Nerun due to adverse slope of land. Besides large scale excavation in and around this city have not provided any debris of any old settlement.
- Towns on the Baran drainage system were: Taung, Pokhan, Jhangari and Desoi.
- Arabian Sea was then called as Bahre-Fars (Persian Sea) due to Persian trading ships dominating this sea.

SETTLEMENTS DURING 700-1000 AD

During the Climatic Optimum the Indus River had re-established itself and became most kind to Sindh's agricultural economy. An eastern course of Indus passed through Alore gorge until about 1000 AD, when the whole river passed through Bakhar gorge bringing importance to Baghrur (Rohri and Bakhar-Sukkur). The western branch of the river Indus, which took off along the alignment of Begari canal and passed to Sindh Hollow, also shot up a branch near Rustam in Shikarpur district almost along the alignment of the Western Nara and met the mother branch near Kakar, and thence flowed to Manchar Lake. The main branch, after leaving Bakhar gorge, had Thul Mir Rukan and Kalari on it, and was passing west of present Nawabshah near the Engineering University. S It also had shot up a loop west-wards along alignment of present Rohri canal from Kandiaro to Saeedabad.

The deltaic eastern branch of southern Sindh started north of Thul Mir Rukan and Brahmanabad stood to the west of it. It ended in the Eastern Puran. The main branch bifurcated some 30 miles east of Jherruck and its western deltaic branch passed near Gujjo and Debal. The main branches ran almost parallel to present course but 30 miles east. So many branches of the Indus brought agricultural boom and prosperity, leading to independent dynasty of Habaris in Sindh.

Barbarican's trade had virtually dwindled around 100 AD, due to discovery of trade winds and direct trade from the Red Sea to the ports of the Indian coasts. It regained importance due to settling of Persian Jews there and with the rise of Sassanian Empire trade with Sindh was boosted via Barbarican (renamed as Debal, after Jewish synagogue or Dewal). Trade with Sindh also resulted in exports from Thar, via a small port of Pari Nagar on the Gulf of Sindh. The trade from this port most probably consisted of salt from salt lakes near Pari Nagar and also cattle, camels, sheep and goats from Thar and from Debal; cotton textiles, rice, indigo, and oil seeds of Indus plains. Sugar was exported to Iran as medicine, and so were poppy products including opium.

PRODUCTS OF KOHISTAN EXPORTED FORM THIS PORT

Major religion of Sindh was Buddhism and that of south-eastern parts of Thar Desert; Jainism. Trade brought prosperity among trading class, who contributed towards building of Buddhist stupas and Jain temples. Virawah and Nagar Parker also flourished on the Gulf of Sindh, which was also fed by the Luni River. Rise of many new towns was the result of comparative stability of the River Indus, which by about 500 AD had delta head near present

Shahdadpur. The deltaic eastern branch had Depar Ghanghro (Jhol), Brahmanabad, Dhaliya (Mirpurkhas stupa) and Naokot on it. The deltaic central branch, which then was the main branch, passed near Jherruck and fed Keenjhar Lake, which had important towns of Jhim (present Jhimpir), Gujjo and Debal on it.

The western branch of Indus leading to Manchar had an important town of Dhamraho on it. Vinjrot, Mathelo and Dribh Dethari were on the Hakra, which was dry but was getting spill waters of the Indus and the Sutlej during inundation season i.e., July and August. Baghrur was small settlement near Alore and depended on water supply from the eastern branch of the Indus, passing through Alore gorge. Change of courses of the river Indus in lower Sindh, around 700 AD, laid waste many important towns in that area, which then survived as insignificant settlements. Such was fate of Naokot, Dhaliya, Nerunkot, Jherruck and Sudheranjo Daro.

TABLE SHOWING TOWNS OF TENTH CENTURY AD; ACCORDING TO IBN HAUKAL AND ISTAKHRI - THEIR LOCATION AND MODERN NAMES

Names according to Arab writers of tenth century	Modern names
Sadusan	Sehwan
Al-Rur	Alore
Kalari	Ruins in Deh Kalari (Nawabshah district)
Mansura (renamed by Arabs in eight century)	Brahmanabad
Nerun	Nerun is not at the site of Hyderabad as is ten to fifteen miles south-west at the foot of Ganjo Takar
Bahre-Fars (Persian Sea)	Arabian Sea
Bania (Baiza)	Kahujo Daro ruins or Dhaliya ruins
Manjabari	Mangho Pir
Daybul	Banbhore
Jhim	Jhimpir

SETTLEMENTS DURING 1000-1500 AD

From the tenth century to the end of thirteenth century, the river changed its course at least thrice in the nearness and below Brahmanabad as Soomras had to shift capital three times; from Mansura (Brahmanabad) to Tharri(ruins in taluka Matli); to Muhammad Tur (ruins five miles north of Jati) and to Thatta. Brahmanabad was burnt by Mahmud Ghaznavi in 1026 AD, and is in ruins since then.

Debal was burnt by Khawarizm Shah in 1224 AD and so was Pari Nagar. Spill waters to Hakra also reduced and settlement of Vinjrot decayed. The hydrological changes, over these five hundred years in the lower Sindh, left many minor branches to flow, resulting in many new settlements, depending on rice cultivation and fisheries. More than one hundred such settlements have been explored and reported in Pakistan Archaeology Number 8. On the western branch of the Indus, in the northern Sindh, rose a beautiful Soomra town of Janani, the ruins of which exist in the Deh of the same name, in Warah taluka, only two kilometres west of Warah town.

The main and central branch of the Indus shot up a branch opposite to Radhan and passing through Maha Lake took the course along Kakar, Baghban, Phaka, Bhan, Samtani, Rel and Arazi, and joined the Indus again creating a vast lake between Sehwan and Talti. This branch made Mehar, Khairpur Nathan Shah, Dadu and eastern parts of Johi and Sehwan talukas as most important area in Sindh in the fourteenth and fifteenth centuries.

Around 1300 AD the western deltaic branch of the Indus in the lower Sindh abandoned its alignment along Kalri canal, and Samui settlement on it decayed. A new port of Lahri replaced Debal. Gulf of Sindh dried up and henceforth was called Kuch-jo-Rinnu (Rann of Kutch). Brahmanabad and Alore were already in ruins from beginning of eleventh century and folk-tales were current about their ruination due to misdeeds of legendary Dalu Rai. Kalan Kot was built probably in fourteenth century along with Thatta. Shah Kapur (Muhammad Tur) was abandoned by deltaic branch Gungro of the river some-times around 1300 AD. By about 1351 AD Janani was already in ruins. It may have been burnt by Sammas, who used violence to overthrow Soomras.

SETTLEMENTS IN 1500-1550 AD

No major change took place excepting that main branch, which had thrown a loop north of Darbelo, opposite Radhan, in the previous century, became the main course and river abandoned its main channel; from opposite to Radhan, to Amri. Towns of Pat, Arazi and Bakhtiarpur, which then were on left bank, are now on right bank. The remains of old course are

shown by series of lakes namely Maha, Sutiaro, Jakhpari, Pir Ghunio and Talti. This also made Mehar, Kakar, Dadu and Sehwan Haveli rich talukas. Like wise Badin (Chachkan) on the Ren River branch in the deltaic zone, was important and rich area of Sindh.

1550-1700 AD - THE LITTLE ICE AGE

This was a period of the Little Ice Age in which snow melt in Himalayas was not only delayed for about fifteen to thirty days, but quantum of water was reduced. Inundation season was also delayed and as a consequence, peak flow of water in the river was reduced. Therefore the river did not change its course, except the loop of river above Darbelo, which was abandoned soon after 1542 AD. No new towns came up. Cultivation was reduced, small settlements were abandoned and large settlements reduced in population and size. Famines were frequent. Major settlements survived in a decayed stage. Some important towns which rose during the period, due to local tribes getting virtually independent in their own areas, were: Shikarpur in Shikarpur district, Ghari in Khairpur Nathan Shah taluka and Shikarpur around 1650 in Dadu taluka eight miles south of Dadu town. These new settlements arose because some important old channels of the Indus were converted into canals. Larkana was such a settlement of sixteenth century on Ghar branch.

European trade expanded and centres of trading with Portuguese, British, Dutch and French flourished and expanded. Such trading places were: Sukkur, Rohri, Darbelo, Sehwan, Bubak, Nasarpur, Thatta, Jherruck, Hala and Lahri Bunder, where Portuguese established a fort and a church. The British established a factory at Thatta. Lahri Bunder changed sites and at the end of seventeenth century a new port Auranga Bunder (after Aurangzeb) was established. This was also short lived and was superseded by Shah Bunder.

SETTLEMENTS IN 1701-1758 AD

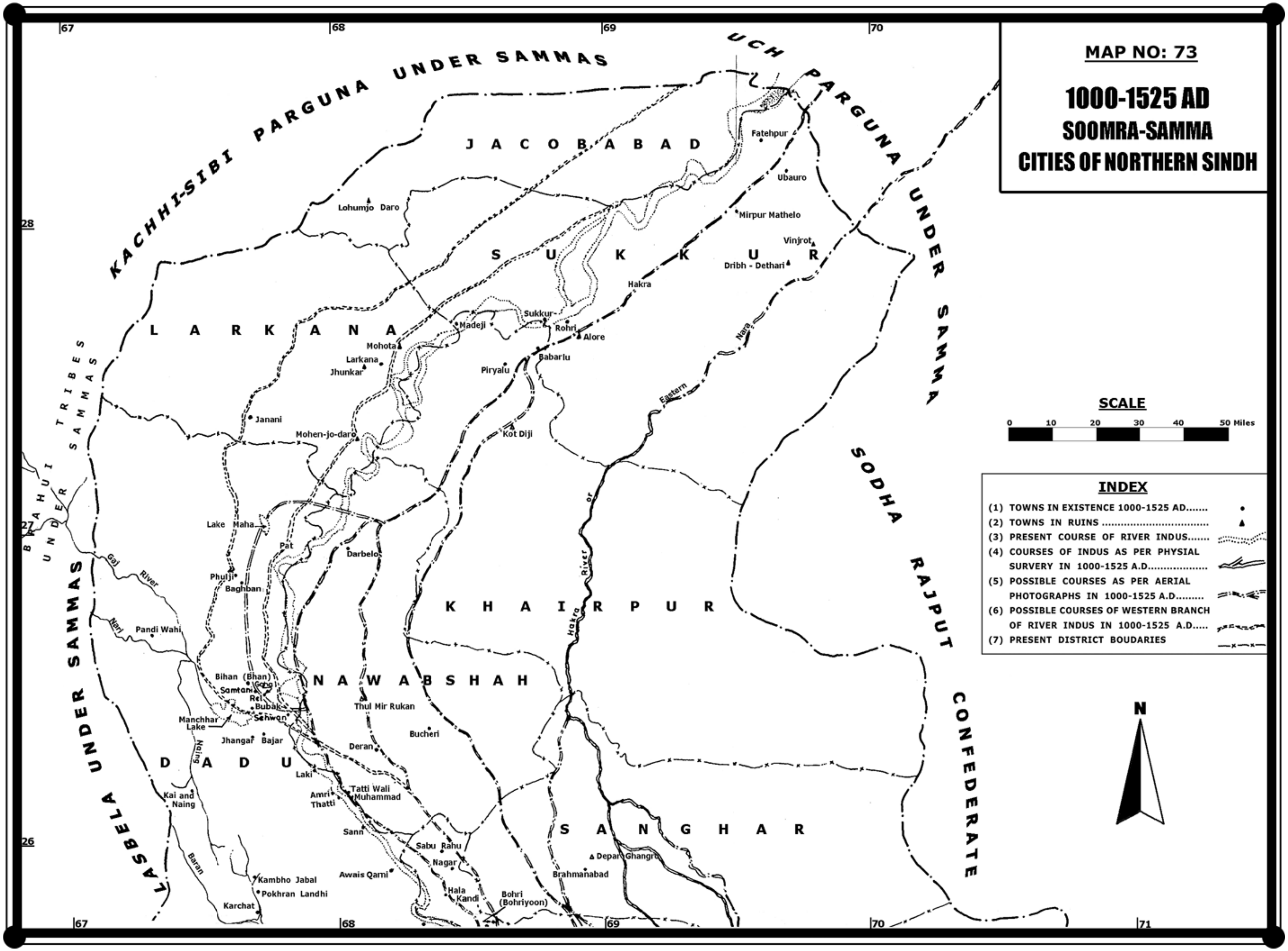
It was the short period of intermediate warming during the Little Ice Age. Kalhoras increased irrigation from about 1.0 million acres to 2.1 million acres and population increased from 1.5 million to 3.0 million. New towns like; Shahdadkot, Kambar, Warah, Mehar, Khairpur Nathan Shah, Mirpurkhas, Khudabad New (near Hala), Shahdadpur, Naushehro Feroz, Tharri, Fatehgarh (Jacobabad), Johi, Dost Ali, Kambar, Ratan Dera (Rato Dero), Waggan etc., came up. Shikarpur in Dadu taluka was re-named as Khudabad and made Kalhoras' capital of Sindh. The other towns established during the period were: Khairpur Mirs, Bhirya, Sadhuja, Moro, Khuhera, Sakrand and Tando Adam.

SETTLEMENTS IN 1758-1843 AD

In 1758 AD the main branch of the Indus changed its course near Hala, which course it had occupied for some five centuries, deserting old towns on it. Some important of these were: Oderolal, Nasarpur, Shaikh Bhirkio, Tajpur, Agham, Tharri, June, Fateh Bagh, Talti, Talhar and Badin. On its western deltaic branches were: Jhok, Bathoro, Pir Patho, Shah Bunder, Thatta, Kalan Kot and Sakro. These survived as less important towns. New course was established along the present alignment, through Hyderabad-Kotri gorge. New towns emerged on it and some old towns also gained importance. Hyderabad, Keti Bunder, Sujawal and Tando Muhammad Khan were new townships. Old settlements like; Budhapur and Sonda gained new importance. Naudero, Lakhi, Junidero and Garhi Khairo also gained importance.

Since one million acres of land were abandoned south of Hala, a large number of small settlements dating back from twelfth to fifteenth century i.e., Samma-Soomra period in the lower Sindh perished. There was massive revolt of tribes in the lower Sindh and political chaos, which resulted into rise of Talpurs, who gradually built canals to irrigate the abandoned area and appropriated lands to themselves. New Talpur-Baloch settlements, usually called Tandos emerged. Tando Mari, Tando Allahyar, Tando Jam, Mirpurkhas, Tando Bagho, Tando Muhammad Khan, Tando Ghulam Ali and Tando Qaiser are an out-come to this change and date back to this period. The Ren River was fed by Phuleli branch, which later on was converted into Phuleli canal. The river has always been used for navigation and river ports at suitable sites on high lands on the river had flourished. If they got eroded a new settlement of the same name would be established for the same purpose on a nearby high land. Manjhand, Budhapur and Unar Pur are towns; eroded, abandoned and rebuilt, three or four times.

Since area under cultivation decreased from 2.1 million acres to 0.9 million acres and since the ruling families and Baloch chiefs, who occupied the land, were


MAP NO: 73
1000-1525 AD
SOOMRA-SAMMA
CITIES OF NORTHERN SINDH
SCALE
0 10 20 30 40 50 Miles
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SODHA RAJPUT CONFEDERATE
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JACOBABAD
SUKKUR
LARKANA
KHAIRPUR
NAWABSHAH
DADU
SANGHAR
Fatehpur
Ubauro
Mirpur Mathelo
Vinjrot
Dribh - Dethari
Hakra
Lohumjo Daro
Sukkur
Rohri
Alore
Madeji
Mohota
Larkana
Jhunkar
Piryalu
Babarlu
Eastern Nara
Kot Diji
Janani
Mohen-jo-daro
Lake Maha
Pat
Darbelo
Phulji
Baghban
Gaj River
Nari
Pandi Wahi
Hakra River or
Bihan (Bhan)
Samtani
Rel
Bubak
Sehwon
Manchhar Lake
Jhangar
Bajar
Thul Mir Rukan
Bucheri
Deran
Naing
Laki
Amri
Thatti
Tatti Wali Muhammad
Kai and Naing
Sann
Sabu Rahu
Nagar
Depar Ghangro
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Baran
Kambho Jabal
Pokhran Landhi
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Hala Kandi
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not hereditary cultivators, they neglected agriculture and populace put emphasis on animal husbandry. The Thar and Kohistan lands were utilised for this purpose and settlements arose in those two areas. Luckily we have before us a 1855 AD detailed map of Sindh on scale 1:504, 480, which indicates a large number of small settlements in Thar and Kohistan followed by settlements along both of the banks of river acting as ports or Bunders. The list is enormous. There were some 729 canals directly taking off from the Indus in 1843 AD. At the heads of these canals were ports and towns, and also were towns between any two canals. Small cottage industry and ware-houses sprung at these ports. One important aspect of Talpur period like Soomras was the development of settlements south of Hyderabad in the lower Sindh, where they concentrated on new canals and had enormous areas under animal husbandry due to rich pastures.

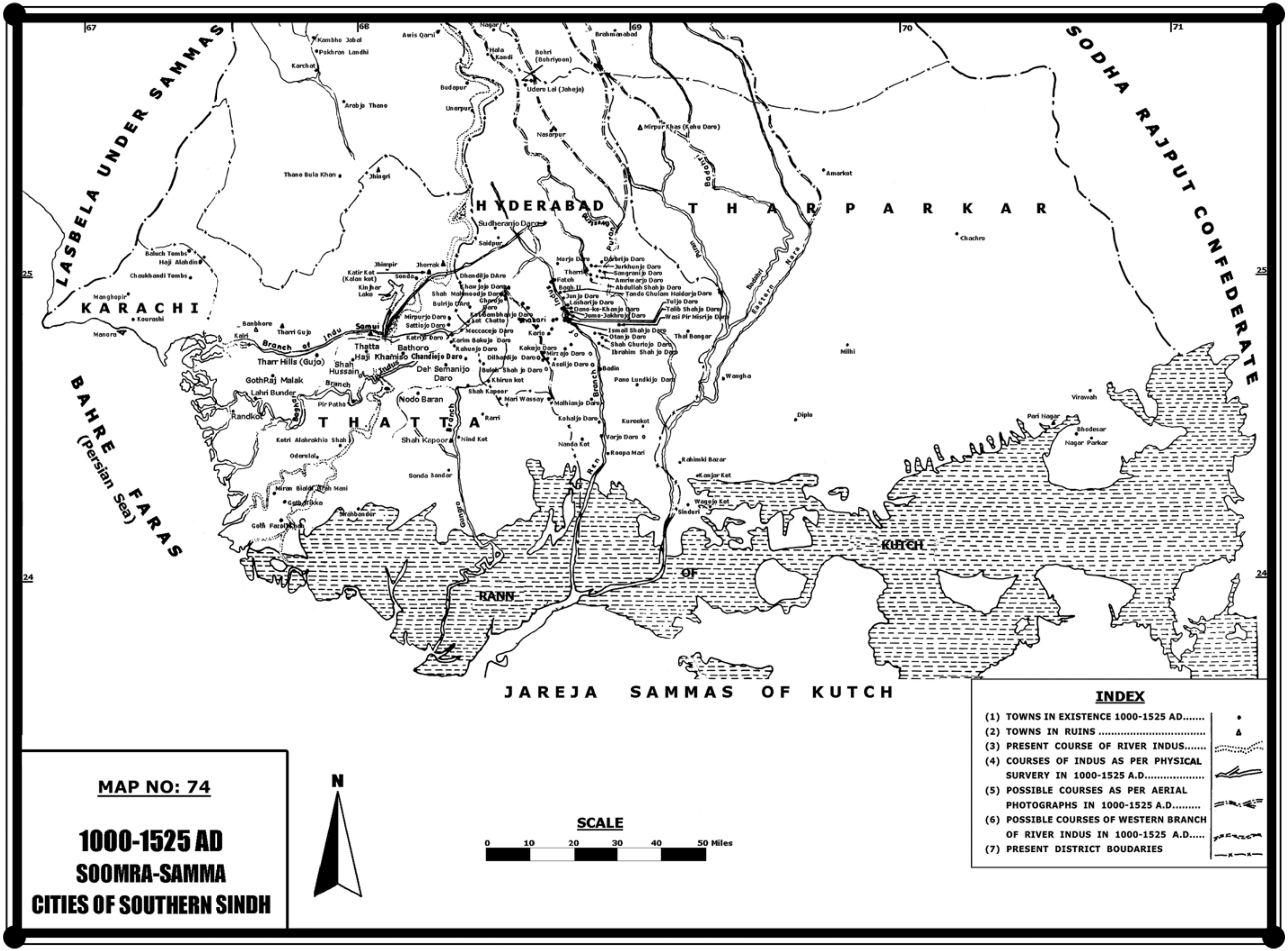
SETTLEMENTS IN 1850-1960 AD

The pattern of settlements started changing after 1860 when the British started extending and improving new canals. Within next 40 years the area under irrigation was three-fold of 1843 AD, and was further doubled by 1955. The population of Sindh had doubled by 1910 and was three-fold of 1843 in 1941. This increased settlements in the irrigated areas, caused decline in pastoralism in Thar and Kohistan by migration of population to irrigated plains.

RAILWAYS CHANGES THE SETTLEMENT PATTERNS

Railways were a new revolution in communication. The dates of start of railway trains in various parts of Sindh are give in table below:

Date of opening	Section of Railways	Miles	Remarks
13-05-1861	Karachi City-Kotri	104.90	
15-05-1861*	Karachi City-Karachi Cantt.	2.30	
01-10-1878	Radhan-Ruk	64.25	
01-10-1878	Sukkur to beginning of Sukkur-Habib Kot realignment M. 5.124	2.45	
08-10-1878	Kotri-Laki Shah Saddar	75.52	
27-10-1878	Laki Shah Saddar-Radhan	70.48	
02-05-1880	Habib Kot-M. 22.79 Sibi	128.53	
27-03-1889	Rohri-Sukkur	2.67	
--------1889	Rohri-Beginning of Rohri-Pano Akil realignment miles 297.50/R	0.66	
18-08-1892	Hyderabad-Shadi Pali	54.97	
15-11-1896	Detha-Rohri	180.70	
20-06-1897*	Karachi Cantt-Pipri	20.78	
30-06-1897*	Kiamari-Karachi City	3.06	
03-05-1898*	Pipri-Kotri	81.82	
25-05-1900	Kotri-Hyderabad	5.29	
15-08-1904	Hyderabad-Badin	61.75	Hyderabad-Badin was dismantled during the First Great War, was reconstructed and reopened in two installments on 9th January 1922 and 13th May 1922, respectively.
03-04-1907*	Reti-Khanpur	62.17	
01-06-1907	Rohri-Reti	71.33	
18-04-1907	Jamrao-Jhudo	49.96	
28-03-1910	Hyderabad-Detha	4.50	
01-01-1912	Mirpurkhas-Khadro (M.G.)	49.43	



MAP NO: 74
1000-1525 AD
SOOMRA-SAMMA
CITIES OF SOUTHERN SINDH
LASBELA UNDER SAMMAS
SODHA RAJPUT CONFEDERATE
JAREJA SAMMAS OF KUTCH
BAHRE FARAS
(Persian Sea)
KARACHI
HYDERABAD
THARPARKAR
THATTA
RANN OF KUTCH
SCALE
0 10 20 30 40 50 Miles
N
INDEX
(1) TOWNS IN EXISTENCE 1000-1525 AD.......
(2) TOWNS IN RUINS ....
(3) PRESENT COURSE OF RIVER INDUS.......
(4) COURSES OF INDUS AS PER PHYSICAL SURVERY IN 1000-1525 A.D..................
(5) POSSIBLE COURSES AS PER AERIAL PHOTOGRAPHS IN 1000-1525 A.D.........
(6) POSSIBLE COURSES OF WESTERN BRANCH OF RIVER INDUS IN 1000-1525 A.D.....
(7) PRESENT DISTRICT BOUDARIES

21-06-1912*	Janvari-Rohri	-	
01-04-1913*	Giddu-Hyderabad	3.71	
11-12-1914	Jacobabad-Kashmore	-	
01-07-1915	Hyderabad-Shahdadpur	45.39	
27-11-1919*	Shahdadpur-Nawabshah	26.07	
25-02-1920*	Nawabshah-Kot Laloo	31.29	
20-05-1930	Pad Idan-Tharushah-Mehrabpur	43.77	
10-12-1931	Tando Adam-Sakrand-Nawabshah	54.05	
10-12-1931	Sakrand-Tharushah	66.20	
29-07-1940	Larkana-Jacobabad	83.98	
16-04-1946	Ruk-Habib Kot	4.95	
16-04-1946	M. 5.124-Habib Kot, M. 20-29	15.16	
16-04-1946	297.50/R to end of Rohri-Pano Akil realignment miles 312.81		
12-10-1956	Jacobabad-Kashmore	75.52	Date of opening 01-12-1914, subsequently converted to BG and reopened on 12-10-1956

* Indicates double lines

Railways saw no expansion after independence, although the British in their Post-War Development Plans of 1945 had proposed rail roads for Jungshahi-Thatta-Sujawal-Badin-Rahimki Bazaar-Nagar Parker. Another railway was proposed to connect Chhore-Chachro-Mithi-Diplo-Nagar Parker to Ahmedabad and a third Dadu-Johi-Kambar. Still a fourth one from Nawabshah-Jaisalmir-Ajmir to Delhi.

The railways changed the settlement patterns altogether. Though they ran a safe distance of minimum ten miles from the river and out side flood protection embankments on both sides of the river and ensured safety from annual flood of Indus to railways settlements and agriculture, but river trade declined very fast and most of river ports, except those which were also railway stations, dwindled much before 1900 AD. Kotri, Sukkur, Rohri, Purano Dero (near Phuleli railway station) Sann, Manjhand, Amri, Sehwan, Laki and Kashmore were stations as well as river ports. Railway line between Purano Dero and Phuleli was removed after the World War-I in 1927, due to main river course shifting three miles further east from Purano Dero and this important trade centre declined to an insignificant settlement within next ten years.

IRRIGATION CHANGES SETTLEMENT PATTERNS

The expansion of irrigation also produced new settlements and important towns. The provincial administration under the British was decentralised to Taluka level. Sindh had sixty-five talukas, in addition to seven talukas of Khairpur State. Taluka head-quarters had schools imparting education leading to Middle School level or to Matriculation. They had posts and telegraph facilities, hospitals, maternity homes and criminal courts, and some had even civil courts. They all had some kind of local/self governments like municipalities or notified area committees. They thus became small centres of power and attracted trade, cottage industry, rice husking and flour mills in early part of 20th century. Some had cotton gins and were also connected to nearest railway stations by raised earthen roads. They changed the pattern of small settlements and became trade and education centres of rural areas.

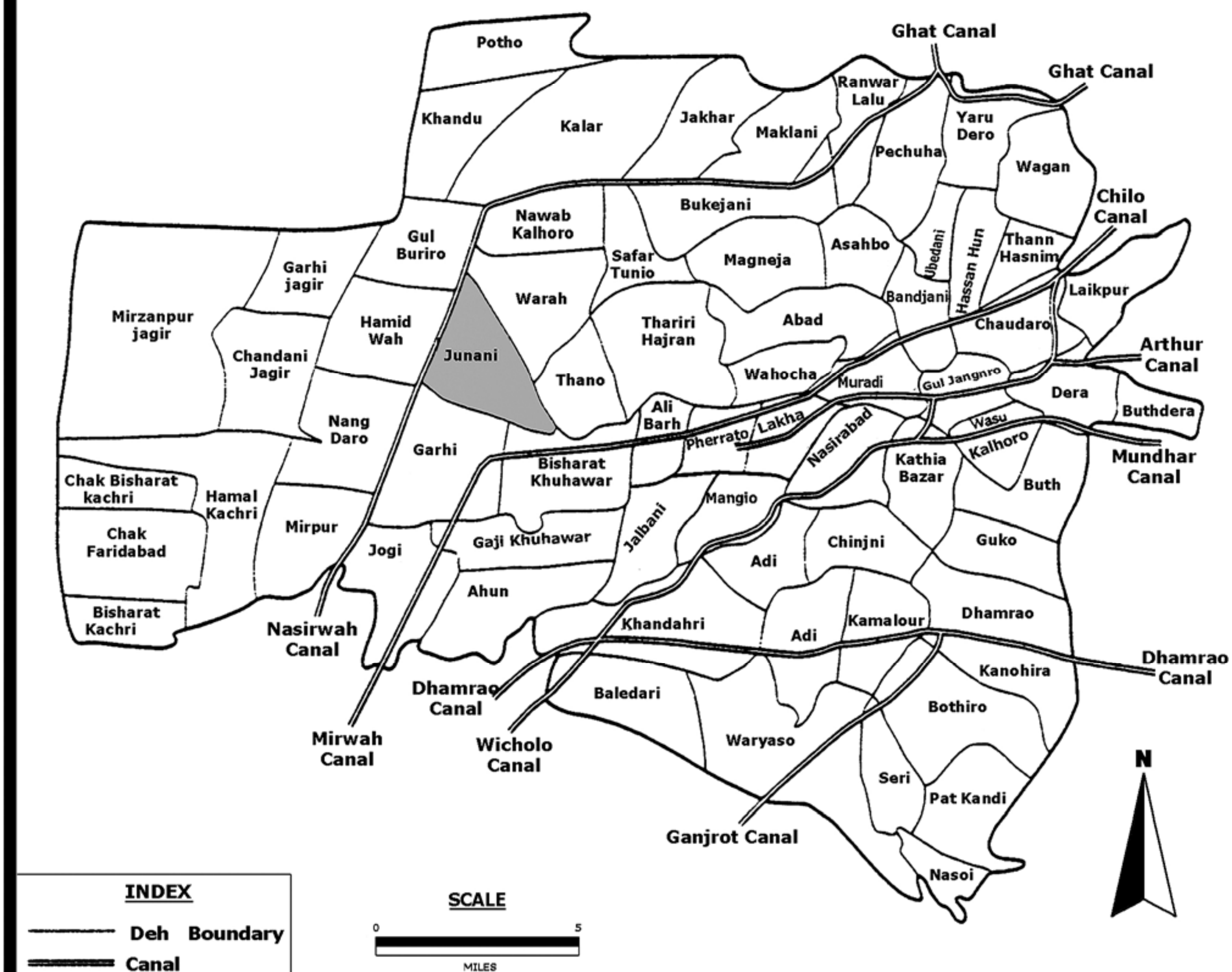
IMPROVED ROADS CHANGE SETTLEMENT PATTERNS

Improved roads were another gift of the British. Camel caravan routes and bullock cart tracks connected all major settlements of Sindh, but during the early British rule, it was Sir Bartle Frere, who within couple of years improved the road system in Sindh, by providing culverts and bridges at government's cost for most of the roads, and asked local land-owners to connect various cities and major settlements by raising earthen roads, along

MAP NO: 75

1894/95 AD

NASIRABAD TALUKA, LOCATION OF DEH JUNANI AND WATER SUPPLY



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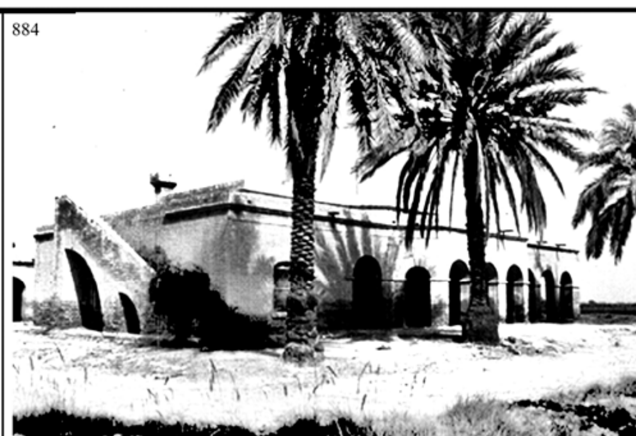


JUNANI INSPECTION BUNGALOW

883. Junani inspection bungalow with servant quarters, stables, etc.
884. Junani inspection bungalow with stairas for sleeping on the roof.

alignments; widths and levels to be provided by the government. The government maintained them by providing sprinkling water and covering them with wild reeds to keep down dust. Since 1920's trucks and buses had been plying on these earthen roads and thus not diverting load of railways, but supplementing and increasing it, by hauling the products to suitable railway stations. They helped in development of towns within reach of railway stations.

With opening of Sukkur Barrage in 1932 Sindh became an important grain and cotton producing province of British India. During World War-II the government needed organized wheat and rice procurement for which the Government of Sindh allotted various areas to different contractors. The railway stations and their towns became centres of godowns and soon a popular phrase was coined. "Railway station such and such, has been allotted to Mr. so and so". This resulted into increase of population, trade and size of settlements at the railway stations.

In 1947, the 1855 map of Sindh looked like a curiosity and show what an efficient foreign administration had done to the face of Sindh in a century of their rule.

The settlement patterns of population under the British rule have not been studied vis-à-vis economic development. Enormous material is available for study and analysis. In general it could be summarised as under:

- The first 50 years of their rule up to 1900 AD, saw great concentration of canals from the River Indus to the low lying lands of Sindh in the north-western Sindh, consisting of Jacobabad, Shikarpur, Larkana and the northern talukas of Dadu district. This was turned into rice cultivation area. As water was available in the canals for one-hundred-twenty to one-hundred-thirty-five days, it led to development of famous high quality Sugdasi rice. The population of Sindh also had high concentration in those districts during this period.
- After development of Jamrao, Mithrao and Nara canals, at the end of nineteenth century, the present Mirpurkhas and parts of Sanghar districts started developing and ultimately in next thirty years they took lead over the districts in the north-western Sindh; economically as well as in population density. Hala and Hyderabad talukas too had expanded population under improved irrigation of Phuleli and Sarfaraz canals from the Indus.
- The Badin and Thatta districts were neglected before the British, as Talpurs had converted these lands into Shikargahs and pastures. The whole area, now commanded by the Kotri Barrage, had become pasture land, but population was limited, due to poor income from milk, and meat and no ready markets for these products.
- After opening of the Sukkur Barrage, development of cotton, citrus and fruit crops started in Nawabshah, Mirpurkhas and northern parts of Hyderabad district. Khairpur district got waterlogged and could not sustain extra population.
- Low prices of grain crops caused economic depression in rice and wheat producing areas from 1930-1939. The worst hit districts were in north-western Sindh.

The above are the general conclusion and need much detailed study and re-verification from the Government Records, which fortunately are plentiful, but available either in Bombay or the India Office (now the British Library), London.

DEVELOPMENT BETWEEN 1960-2000 AND CHANGES IN SETTLEMENT PATTERNS

The major developments of the period are:

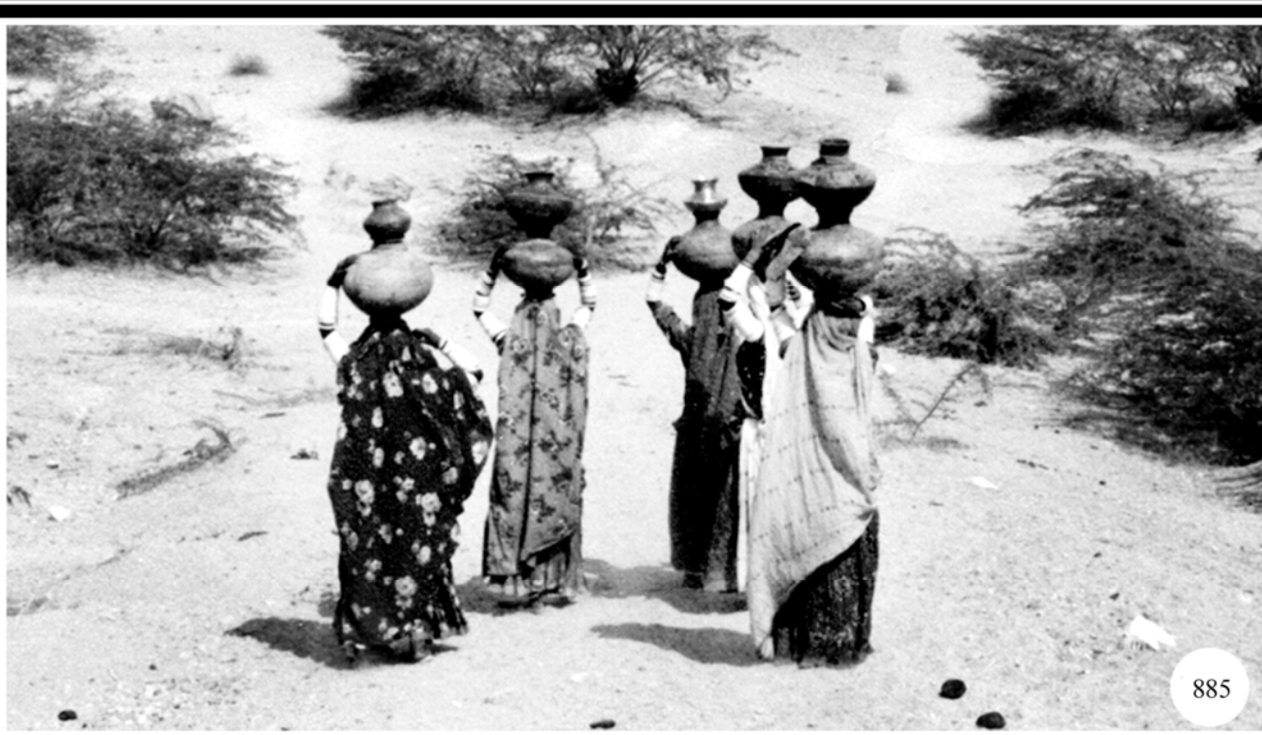
- Opening of the Kotri Barrage in 1957 AD and release of 1.6 million acres of government land on it, after 1960 AD, in addition to assured water supply for 1.1 million acres of private land.
- Opening of Guddu Barrage in 1962 and release of 1.1 million acres of government land, in addition to assured water supply to 1.6 million acres of private land.
- Release of 2.8 million acres of government owned land in the Sukkur Barrage after 1960, in addition to 5.5 million acres already commanded by it.
- Introduction of tube-well technology in 1958 and installation of 3,000 private tube-wells in sweet ground water zone between 1960-1970. After 1970, 13,000 private tube-wells have come up in addition to 4,000 fresh water tube-wells of the government, in fresh ground water but water-logged lands.
- Introduction of modern fruit orchards beginning

with Hyderabad district and expanding to Mirpurkhas, Nawabshah, Sanghar, Khairpur and Sukkur districts.

- Introduction of bananas in Thatta, Hyderabad, Mirpurkhas, Sanghar and Nawabshah districts after 1958. Today this industry is doomed by Banana Bunch Top Virus.

These developments in next thirty years could absorb more than double the population of rural areas as it was in 1950. This increased new settlements in the rural areas, towns started swelling and communication also improved. In 1960 the regime, having been influenced by experience in America (where passenger trains got set back due to improved road transport), started building bituminous roads, promoted goods transport and caused continuous congestion in spite of additions of roads. By 2000 there was a vast system of roads in operation, which made population more mobile than it ever was. People now want to benefit by urban amenities. The rural population in 2000 was four times that of 1951 and urban population is multi-folds. The government also encouraged planned industrialisation after 1960 and since due to release of 5.5 million acres of the barrage land the rural labour in Sindh was not surplus for thirty years, the industries had to be manned by labour from the other provinces, leading to very fast expansion of cities. Today Karachi and Hyderabad have almost thirty times the population, what they had in 1951.

This has created misbalance in the rural and city settlements, leading to complicated socio-economic, ethnic and cultural disparities and political problems.



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SINDHI WOMEN AT WORK

In Sindhi society division of labour between men and women makes women to fetch water for the families from wells, springs and lakes sometimes a few miles away, separating butter from yogurt and husking of grains. Ploughing is exclusively men's job and so is grazing of animals. Cutting grasses for animal feed is men's job, but with many animals women may help. Women also help in harvesting wheat, rice, cotton and vegetables, but hauling them is men's job. Women invariably help in transplanting of rice. Cooking and washing clothes is women's job. This division of labour evolved during early Neolithic societies in Asia and still holds good.

885. A group of women carrying water jars in present Sindh.
886. Women weaving ordinary cloth common up to 19th century. It is still woven for specially cloths like loongi, khes etc even in 21st Century

APPENDIX III

HAKRA OR SARSUITI CONTROVERSY; VARIOUS VERSIONS OF SCIENTISTS, HISTORIANS AND FOLKLORISTS

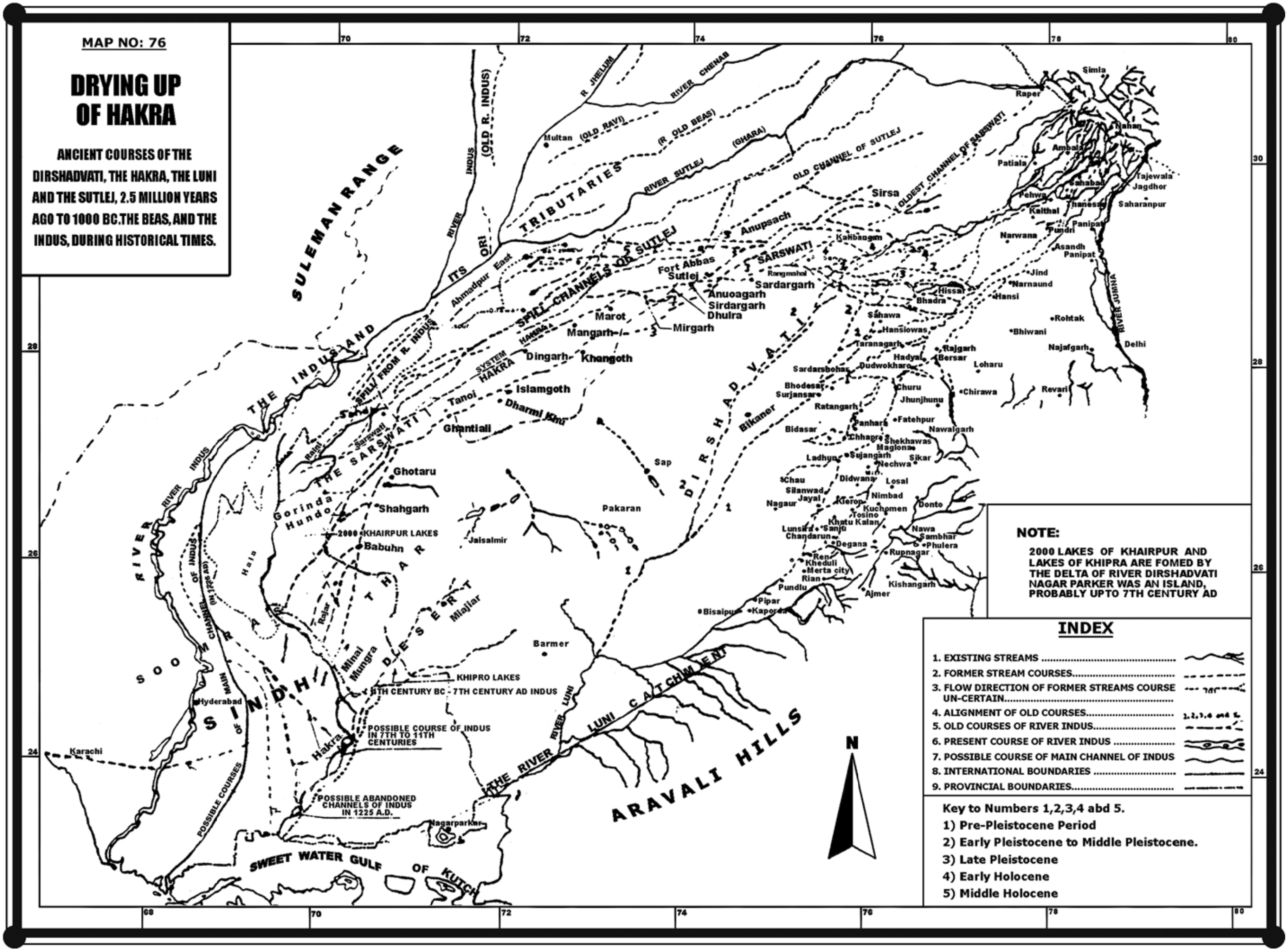
The Hakra was not a controversial issue one-hundred-and-seventy years ago, as very few people had heard of it and these had their own imaginations and explanations. For such opinion, they owed responsibility to none, as they would not be challenged, due to lack of mass media. The British investigators always verified the facts, and controversy once started, was ultimately resolved by most scientific methods, available in each decade. The Hakra question was such a controversy with different versions and it took about one-hundred-and-fifty years to resolve the issue. Unfortunately the issue still remains too confused, before the people of Sindh, due to lack of communications. There are three types of versions, based on three classes of investigators:

- Scientists
- Historians
- Folklorists

Historical versions on Hakra recorded mostly in the seventeenth century and afterwards cannot be considered authentic, especially about the events which in this particular case, took place around 2,000 BC, or even in eleventh to thirteenth centuries AD. Although historians of these works have been too assertive, the fact remains that their source of information was contemporary folk-lore. Folk-lore on the other hand is full of eulogies and exaggerations, and the story tellers (Sughars) have given free reign to their imaginations, which have changed from occasion to occasion, according to how good a Sughar was. The very Sindhi language used in folklore does not show its antiquity to more than two-hundred-and-fifty years, barring a very few isolated cases. Under any circumstances, the recorded and intelligible poetry of Sindh cannot be assigned a date earlier than fifteenth century. Folklore, therefore, is not a media to resolve an issue, totally contradicted, as it is, by the scientific evidence.

It is worthwhile to describe briefly the continuous efforts that have gone into the probe, to find out if the Hakra was an independent river or it was the Sutlej or some other river of antiquity. It is also certain that new facts will always come to light, clarifying the position further.

1. The earliest mention of Hakra is by Alexander Burnes, a diplomat who in 1833, while describing the eastern branch of the River Indus, (formerly taking off from the main stream, on its up stream's side above Rohri, was irrigating large tracks of land in the eastern desert), mentions of diverting of its waters by Ghulam Shah Kalhora in 1761 AD to dry up the rice fields near Lakhpat in Kutch, and also alternations produced by an earthquake of 1819 AD, on the waters of the Hakra or eastern branch of the River Indus.
2. Similar views were expressed by many other writers including McMurdo and the early Gazetteer of Thornton, who thought that the Eastern Nara took off from the Indus at north of Rohri. W. Pottinger and Del Hoste also held similar views.
3. Richard Fransis Burton, a surveyor, linguist and scholar was the third writer, who described Hakra as an ancient course of the River Indus, in his various writings. He used Mamui Fakirs' poems in support of Hakra and its courses.
4. Fife, the first Superintending Engineer in Sindh, who opened the Eastern Nara Canal, thought that the Eastern Nara was spill channel of the Indus rather than an eastern branch, but was getting water constantly from spill channels of it, in the former (ancient) days and occasionally in subsequent years. This was the first major deviation from the thinking of the times, but was not totally correct, as he had no information


MAP NO: 76
DRYING UP OF HAKRA
ANCIENT COURSES OF THE DIRSHADVATI, THE HAKRA, THE LUNI AND THE SUTLEJ, 2.5 MILLION YEARS AGO TO 1000 BC.THE BEAS, AND THE INDUS, DURING HISTORICAL TIMES.
NOTE:
2000 LAKES OF KHAIRPUR AND LAKES OF KHIPRA ARE FOMED BY THE DELTA OF RIVER DIRSHADVATI NAGAR PARKER WAS AN ISLAND, PROBABLY UPTO 7TH CENTURY AD
INDEX
1. EXISTING STREAMS
2. FORMER STREAM COURSES
3. FLOW DIRECTION OF FORMER STREAMS COURSE UN-CERTAIN
4. ALIGNMENT OF OLD COURSES
5. OLD COURSES OF RIVER INDUS
6. PRESENT COURSE OF RIVER INDUS
7. POSSIBLE COURSE OF MAIN CHANNEL OF INDUS
8. INTERNATIONAL BOUNDARIES
9. PROVINCIAL BOUNDARIES
Key to Numbers 1,2,3,4 abd 5.
1) Pre-Pleistocene Period
2) Early Pleistocene to Middle Pleistocene.
3) Late Pleistocene
4) Early Holocene
5) Middle Holocene
N
SULEMAN RANGE
ARAVALI HILLS
SWEET WATER GULF OF KUTCH
THE RIVER LUNI
LUNI CATCHMENT
THE INDUS AND ITS ORI TRIBUTARIES
THE SARSWATI
DIRSHADVATI
SPILL CHANNELS OF SUTLEJ
HAKRA SYSTEM
THAR DESERT
SINDH
SOOMRA
2000 KHAIRPUR LAKES
KHIPRO LAKES
5TH CENTURY BC - 7TH CENTURY AD INDUS
POSSIBLE COURSE OF INDUS IN 7TH TO 11TH CENTURIES
POSSIBLE ABANDONED CHANNELS OF INDUS IN 1225 A.D.
POSSIBLE COURSES
OLDEST CHANNEL OF SARSWATI
OLD CHANNEL OF SUTLEJ
RIVER SUTLEJ
RIVER JUMNA
RIVER INDUS
(OLD R. INDUS)
R. JHELUM
RIVER CHENAB
Karachi
Hyderabad
Multan
Delhi
Bikaner
Barmer
Jaisalmir
Pakaran
Nagarparker
Ajmer
Sirsa
Hissar

about courses of the Hakra in Bahawalpur, Bikanir and Ambala.

5. In 1871, Cunningham, the first Director General of Archaeological Survey of India, expressed that Rainee, Solra and Chautang were different from the Sutlej, and met the Indus above Arore (Alore). The Eastern Nara was an old bed of the Indus. It bifurcated near Jakhro into Puran, flowing south-west course passed Hermetelia (Brahmanabad), Patala (Hyderabad) and turned south-west towards Guni to join the main stream. The other branch turned south-east past Umarkot to meet the first branch near Wanga Bazaar, on its way to Koree Creek's mouth. Since in his time, Indian archaeology was just born and was based on history, the results depended on how good the historical works referred to for the purpose were.
6. In 1874, C.F. Oldham, of the Survey of India, wrote that Sutlej was discharging its waters in the bed of Sarsuiti or Ghaghar, which in Sindh is known as the Eastern Nara, and continued doing so until about the quarter of thirteenth century, and the Eastern Nara was not bed of the River Indus as assumed by 1,2,3 and 5 above. His information came from official records and maps of the Survey of India, which showed depressions as they existed physically.
7. In 1875, an anonymous writer of India under a pseudonymous name Nearchus, contradicting No.6 above, stated that the Sutlej never flowed west-wards directly into the Indus, but it was the Jammuna instead, which once flowed west-wards and fed the Hakra. He also supported the view of 1,2,3 and 5 above that east of Rohri the Indus passed through the bed of Eastern Nara.
8. Huges, an ICS officer, in his 'Gazetteer of Sindh'(1876), considers the Eastern Nara or Hakra an old bed of the River Indus and having its source from the Indus, between Bahawalpur and Rupar. He discards Fife's theory completely and thinks that spill water of the Indus near Sabzalkot and Ghotki may have been just another source of supply of water to it, rather than the sole source.
9. In 1886, R.D. Oldham, of the Geological Survey of India, based on hydrological studies, stated that the Indus could not have flowed into the Eastern Nara at all. It was Jammuna in the recent geological times i.e., during Pleistocene or 1.7 million to 10,000 years ago to present times that fed the Eastern Nara. In general he supported C.F. Oldham's opinion expressed twelve years earlier against Nearchus' views. This opinion was respected by some researchers until aerial photography rejected the Jammuna theory.
10. Some how this infuriated Raverty, of Survey of India until 1865, who in 1892 wrote an article of 350 pages, theorizing that there was a mighty river formed by the combined water of Jhelum, Chenab, Ravi and Beas all of which discharged into that river and then passed through the bed of Eastern Nara. The Indus too discharged into this river as its tributary and combined stream of this mighty river was called the "Mihran". Its main course was along the alignment of Sutlej in the Punjab and the Eastern Nara in Sindh, through which it discharged into the sea via the Koree Creek.

   Raverty's maps were highly inaccurate, his theories were imaginary, but he had used vast historical material from Persian, Arabic, Portuguese, French and English sources, and for the general history of Sindh, the book is still indispensable. His courses of River Indus and Hakra with reference to chronology of the historical geography of Sindh are un-acceptable, but his approach has misled many subsequent and some leading historians of Sindh, who have periodically repeated, what was stated by him, and created historical blunders.
11. In 1894 Major General Haig produced a short but well written history of Sindh. Although he avoided getting into the hot bed of controversy, his approach leaves no doubt that he too believed that the Eastern Nara was the bed of the River Indus.
12. In 1904, Col. Minchin and J.N. Barnes, after study of physiography of Bahawalpur State, concluded that the bed of the Hakra was too narrow to have carried all of the Sutlej's waters through it, leaving aside that of the other Punjab river s or the Indus. Thus, it must be an independent stream. However, they did not probe into Bikanir and Ambala area, to get to original courses, leading from Ambala to the Hakra or Sarsuiti.
13. In 1906, Henry Cousens, an archaeologist, became the first writer who drew the course of the major branch of the River Indus, the Lohano Dhoro, at the time of Arab conquest of Sindh in 711-712 AD, between the present course and the Eastern Nara. Unlike Fife (Superintending Engineer in Sindh), he did not think that Nara

was a spill channel of the Indus. He believed that Nara was the bed of another branch of the River Indus.

14. In 1924, Ward, a geographer, basing on the general theory that all river s in the northern hemisphere have westering tendency due to rotating of earth from west to east, stated that the Sutlej, which now has westered, was one time tributary of the Hakra, which passed through the Eastern Nara. The Jammuna may have fed it too.
15. In 1929, Khan, a historian, theorized that Hakra was a tributary of the Indus and not of the Sutlej or of the Jammuna i.e., the Sutlej was tributary of the Hakra. The Eastern Nara was the bed of the Indus through which passed the combined waters of Indus and Hakra, and was called the Mehran. Hakra dried up in about the middle of thirteenth century AD.
16. In 1932, Whitehead, an archaeologist, stated that the Sutlej could not have oscillated 70-80 miles to pass through the Hakra and it seems to have dried up due to diminishing rain fall in the Ambala area, and consequently the Ambala streams dried up.
17. R.D. Oldham, in a personal communication to Pithawalla in 1933, mentioned that at an early date when Jammuna flowed west-wards it probably followed the same course as Hakra did in the later times, as shown in Whitehead's map.
18. In 1942, Stein, an archaeologist, after examining a number of sites in Bikanir and Ambala, concluded that the Ghaghar or Hakra at one time carried the combined waters of a number of streams, including one or two spill channels, to the Sutlej in Bahawalpur and also of a channel of the Indus through the Alore gap near Rohri.
19. In 1942, Ali, a geographer, discussed the problem desiccation of Ghaghar or Sarsuiti or due to declining rain-fall in its catchments that led to its drying up.
20. Pithawalla, writing in 1959, states that a portion of Hakra waters seems to have been derived from spill waters of the Sutlej, when it flowed further south. Ambala streams reduced in size owing to accumulation of silt and sand, and finally Hakra dried up. The Hakra seems to be a distinct, moderate and perennial river system, flowing around the corner of Bahawalpur and Sindh, and almost parallel to this border. It was a degrading stream, having cut a channel of its own, now known as Nara and quite unlike mature type of aggrading the Mehran or Indus of Sindh. The Indus itself did not flow through the Hakra valley. Had the Hakra not dried up because of failure of supply in its upper reaches, the process of depositing silt and raising its own level by the Indus on the one (west) side and that of excavating its own channel on the other side (east) by the Hakra, would have resulted in a sudden breach of the Indus into low lying channel, the Eastern Nara, from which it could not have been able to get out without raising its bed to the level of adjoining plains. The Indus on account of its westering tendency left Alore gorge dry and occupied Bakhar gorge.
21. In 1963, M.H. Panhwar, using his theory that where ever a river like the Indus has flowed for a number of centuries water from it must have seeped underground and left large quantities of sweet water, in a considerable depth and width, and these could be tapped for irrigation, verified this fact by actual drilling. It turned out that there was no ground water along the Rainee and the Eastern Nara, right up to Sindhuri in the Rann of Kutch, except very small quantities of water in a very narrow width and a shallow depth tapped by dug wells. From Alore to Jamrao Head, situation was only slightly better. He attributed the latter to the Eastern Nara canal, having been flowing in that length for over a century now. In his opinion the Indus did not flow through the Eastern Nara bed and Nara or Hakra was minor river that had dried up many centuries ago, except that, in occasional years, it received spill waters from the Indus and the Sutlej. He also found presence of some course of a desert river in Khipro taluka. These courses were finally confirmed sixteen years later by Ghose and others, by remote sensing.
22. In 1964, M.H. Panhwar, drew district-wise maps of the old courses of the River Indus through historical times, discussed the sources and events which indicated the existence of the River Indus at various places throughout the historical times and also proved this by existence of ground water at these courses. There was a small improvement on Pithawalla's work of 1959, in terms of historical sources and courses, but ground water occurrence was a new idea.
23. Lambrick's classical work and analysis of the historical geography of Sindh (1964) is very well written and well discussed document on the Hakra, but he has not acknowledged Pithawalla's findings on the Indus-Hakra

controversy, although this portion of Lambrick's work is extracted from Pithawalla almost verbatim. What is more interesting is that Pithawalla has listed authorities from 4 to 18 above and so had Lambrick in the same order, but has omitted 4,5,8,11,15 and 17, comparatively less important sources. However, on the merits of evidence of historical courses of the Indus, this book has not been superseded for decades.

24. In 1965, Holmes, working with McDonald and Partners on the Lower Indus Project, based on aerial photographs, worked out courses of River Indus during various historical periods and published such information in Vol.2 of the supplementary volume of the report. This was reprinted in Geographical Journal. He found no clue of the Hakra discharging into the Indus, but found Khangarh flood plains edging the desert in the alluvial plains, caused probably by spill channels of the Indus. His maps show Rainee and Wahind totally in the desert and not entering the Indus plains.
25. In 1966-67, M.H. Panhwar drew a map, on scale of 1:250,000, of the courses of the River Indus in Sindh, during the past 5000 years, based on aerial photographs and found spill channels from the Indus towards Rainee in Sukkur district, and also a branch of the Indus passing through Alore gap.
26. In 1968, Raikes, probably influenced by Pithawalla (20 above) and Lambrick (23 above), emphasized that the Jammuna was alternatively captured by the Indus and the Ganges systems. This theory, besides remote sensing of Ghose (31 below), was also rejected by Rao etc (1974) basing on the evidence of the Jammuna fault along the west bank of this river , showing that the river Jammuna could not have westered.
27. In 1969, Wilhelmy wrote on Sarsuiti problem, depending mostly on sources cited by Pithawalla. He mentions that Jammuna formerly flowed west through the present Hansi-Hissar branch of the western Jammuna canal and was known as Drishadvati.

    Aerial photographs have completely rejected this theory of Jammuna flowing westwards. He does not think that the Hakra was tributary of the Indus. According to him the Jammuna was captured by the Ganges in Rig Vedic times. He seems to have been influenced by Lambrick (23 above) and Raikes (26 above). The latter believed that the Jammuna was alternatively captured by the Indus and the Ganges systems.
28. In 1969, M. H. Panhwar, by use of aerial photographs, showed that Hakra, getting spill waters of the Sutlej and the Indus, bifurcated at Jamrao Head and its western branch passed along the alignment of Jamrao canal, then passed to the east of Brahmanabad-Mansura site and again joined eastern branch of the Indus many miles south, on way to the Koree Creek, via the present Dhoro Puran above Brahmanabad-Mansura. It was also fed by an eastern branch of the Indus in Badin Taluka, making its lower part perennial.
29. In 1972, Gurdip Singh and others, after Radio-Carbon Dating of stratigraphy of three salt lake deposits in Rajasthan concluded that between 9,500 to 4,000 years ago rain-fall in the western Rajasthan was one stage higher and about two to two-and-half times the present rains and there was adequate rain-fall in Ambala districts and the adjoining Himalayas to start run-off streams of some importance. From this it was inferred by the subsequent writers that a number of streams were flowing south form Ambala district and the Sarsuiti or Hakra, being one of them during that period, was a perennial river.
30. In 1979, Rafique Mughal, of Archaeological Department of Pakistan, after survey of archaeological sites along the Hakra in Bahawalpur, put forth the evidence that the mature Indus settlements in Bahawalpur started declining around 2,000 BC due to declining waters in that river . This supplemented Stein's work in the Indian territories (18 above).
31. In 1979-80, Bimul Ghose, Amal Kar and Zahid Hussain, by use of Landsat imagery and aerial photographs, produced courses of the Sarsuiti through Rajasthan to the Luni, through the Rainee and the Eastern Nara and through the north-western part of desert in five different stages namely; earlier course and three successive major courses - the later one being Ghaghar-Hakra through Bahawalpur to Rainee. The three intermediate courses met present Nara in Khipro and Khairpur areas. There is also a course of some river entering Sindh and meeting Eastern Nara north of Umarkot, but traceable only to some reach and not to the above five systems. This may have been a course before author's five successive stages.
32. In 1984, Amal Kar and Bimul Ghose, with the

help of aerial photography, concluded that there was no evidence proving that the Jammuna flowed west-wards to feed the Drishadvati. They also concluded that the Drishadvati had several courses by which it flowed south-wards through the desert and was also supplied water from streams originating in the Aravali Hills. Its drying up therefore was mainly on account of climatic changes.

There already existed as much controversy on the Drishadvati as on the Sarsuiti or Hakra. For example; Cunningham (5 above) considered Hansi-Hissar branch of western Jammuna canal as lower course of this river ; Rapson considered it as present course of the Chautang; Keith and Dey considered its course along the Chautang and then through Hansi-Hissar branch of the western Jammuna canal. Further identification was made difficult by similar views of Vishashtha, Sharma and Amal Kar, and Ghose's use of remote sensing identified capture of some of tributaries of Drishadvati by Jammuna and not vice-versa.

An interesting finding contradicting their previous studies of 1979 and 1980 (31 above) was that only an eastern and less important branch of Drishadvati flowed to the Luni in early times and it collected rain water from Aravali mountains en-route, but later on, westered to pass through the centre of desert up to 74 longitude E, and is difficult to trace further beyond this parallel.

At a third stage the Drishadvati, to become a tributary of the Sarsuiti or Hakra system, went through a number of stages at various times, while Hakra or Sarsuiti too kept shifting west-wards.

The authors found it difficult to date the course of Drishadvati, but think that major trend of shifting was from east to west and most probably the river flowed to the Luni prior to start of aridity during the Pleistocene period.

33. In 1985, M.H. Panhwar, on verifying courses of Drishadvati, as given by Kar and Ghose, found that the River Drishadvati could have three different major courses in the antiquity - the earliest course discharged into the Luni and the subsequent two courses passed through the central part of the western Rajasthan desert towards Sindh, where they joined Hakra. The earlier course was to the north of Umarkot and the last course passed through Nara and Khipro talukas. The first of these three courses was considered to belong to the pre-Pleistocene, by the Central Arid Zone Research Institute, and second and third to Pleistocene.

With the help of aerial photographs Panhwar came forth with a theory that the 2,000 soda water lakes in Khairpur and Khipro talukas may have been formed by the Drishadvati River , which flowed in these talukas and the lakes of Sanghar district - the Makhi-Farash depressions were formed at the confluence of Drishadvati with the Hakra system. His main source was 32 above and he felt that Drishadvati may have passed through the central part of Sindh's Registhan or the eastern desert. Drishadvati, along with the Hakra, dried up due to reducing rain-fall, around 2,000 BC.

This statement was true for Sindh's lakes but due to lack of aerial photographs it was not verifiable for the Indian side.

34. After the last finding, the present writer kept probing further into the Sindh desert and on examination of latest 1:50,000 maps, which are based on aerial photographs, found that the direction of lakes of Khairpur and Khipro was NNE to SSW. The Drishadvati formed lakes including Chotiari, Makhi and Farash.

He also found two branches of some ancient river coming from the north-east direction and meeting the Hakra near the present town of Umarkot.

35. CONCLUSION

The whole issue was re-opened. The work done by the Indian authors (31 and 32), and the Central Arid Zone Research Institute Jodhpur, on ancient river s of Rajasthan, was re-examined and this was further supplemented by remote sensing studies in the Registhan or the Eastern Desert of Sindh. Following are the conclusions arrived at and are illustrated in the enclosed map:

i. The Saruiiti (Hakra) and the Drishadvati changed their courses a number of times in the Ambala district and Haryana State, due to heavy load of silt they carried from the denudating Siwaliks. The numerous old streams existing here represent various channels of the Sarsuiti and the Drishadvati system, over many a millennia.

ii. The Drishadvati and the Sarsuiti of Aryan Vedic

and religious literature were two distinct river s in the beginning but by the time Aryans reached that area, these had joined together to form one stream, which at various times fed the Eastern Nara or Hakra.

iii. The Chautang, one time considered a tributary of the Hakra, was the main stream of the Drishadvati and later on when the Drishadvati discharged in the Sarsuiti, it indirectly became a tributary of the Sarsuiti.

iv. The Drishadvati is another name for the Chautang. Its earliest recognizable course was approximately; Rajgarh, Hadyal, Churu, Ratagarh, Mokala and Pundlu.

v. Due to existence of Jammuna fault in Siwaliks the Jammuna could not have flowed west-wards through the bed of the Hakra, which is too narrow to carry its waters.

vi. South of Simla, between the towns of Jagadhar on the east and Patiala on the west, there are at least seven beds of ancient streams, and also two more to the west of Patiala. All these flow NNE to SSW and merge into each other forming two major streams - the Drishadvati to the east and Sarsuiti to the west. The Drishadvati is represented by the eastern most stream, now called the Chautang, and the Sarsuiti by the rest eight streams, which are considered its tributaries, although stream capture was common between the two throughout their life time.

vii. It appears that during pre-Pleistocene period (more than 2.0 million years ago), the Drishadvati discharged into the Luni River below the town of Bishalpur, some 250 miles east of Sindh border on 26th parallel. The Luni carried its water to the Gulf of Sindh, probably near the town of Virawah and Pari Nagar, making Nagar Parker an island. The Drishadvati's nearest point was 260 miles away from Nagar Parker. It could never have flowed through the lower Sindh. The Sarsuiti also flowed NNE to SSW to meet the Drishadvati west of Churu and the combined stream discharged into the Luni near the town of Pachapadra.

viii. During the early or the lower Pleistocene (2.0 million to 500,000 years ago), due to start of aridity, the Drishadvati's water reduced and it could not reach the Luni. It then westered to meet the Sarsuiti in latter's new course parallel to its old course. The confluence was midway between the towns of Nagaur and Jaisalmir and north of Jodhpur. The tectonic movement in the head reaches of the Drishadvati and the Saruiiti in Siwaliks may, to some extent, have been responsible in changing courses of these streams, but the major factor was large amounts of silt, which they carried with themselves from Siwaliks and deposited it down stream blocking their own path. It is not certain whether united stream of the Drishadvati and the Sarsuiti entered Thar, but two branches of some river coming from the central part of the western Rajasthan desert entered the Indus plains near present Umarkot. It appears that either Drishadvati alone or combined waters of the Sarsuiti and Drishadvati system, which entered Sindh at this point, followed the western edge of Thar to the Rann of Kutch via Rahimki Bazaar and thence to the sea.

ix. Further changes took place during upper Pleistocene i.e., 35,000 to 10,000 years ago. The Sarsuiti westered towards the Indus system, running parallel to the Sutlej for some distance and then making a NNE to SSW turn, towards the central and the northern Sindh in four major and a number of minor shifts. Chronologically these four major shifts took place in following stages:

a) Sirsa to Kalibangan, Khangarh, Islamgarh, Dharmi, Khu, Ghantiali, Shahgarh, Babuhri, Rajat and Mihar Mungra, and further along the Eastern Nara to Koree Creek, touching westering edge of Registhan or eastern desert.

b) Sirsa to Kilibangan, Anupgarh, Sarkhi, Darwar, Mithrao and Mandra, and further along the Eastern Nara to the Koree Creek.

c) Same course up to the Mithrao as above, but further down to Wahind branch and from there along the Eastern Nara to the Koree Creek.

d) Same course up to Mithrao, but further to Sandhand, Rainee and from there to the Eastern Nara and the Koree Creek.

e) During the early and the middle Holocene, series of further changes took place in westering of the Sarsuiti. New courses were established from Anupgarh. These were as under:

- From Anupgarh to Fort Abbas and to the north of Darwar. From there towards the Rainee and from the Rainee along the Eastern Nara to the Koree Creek.
- Anupgarh to Ahmedpur and from there to the Rainee.

- Anupgarh to Ahmedpur and further to the Sutlej.
- While it entered the Sutlej it was still flowing to the Rainee and the Eastern Nara.
- During this period the Drishadvati seems to have westered from its course of the Chautang to Hissar, Nihar, Suratgarh and Anupgarh. At Anupgarh the Drishadvati had confluence with the Sarsuiti.

x. The Sarsuiti had a number of tributary streams in Ambala district of the Punjab, Haryana State and Ganga Nagar district of Rajasthan. These tributaries covered a wide valley extending from the Siwaliks and area presently occupied by towns of Dadwali, Ganga Nagar, Jakhal, Tajewala, Jagadhar, Panipat, Thandesar and Patiala - almost a catchment area of about 10,000 square miles, from which it drained its summer and winter monsoon waters, as well as Himalayan snows, making the Sarsuiti a perennial river .

xi. The Sutlej in its upper reaches contributed some water to the Sarsuiti, through some of the branches starting at the east and the west of Ludhiana and meeting it at Jakhal, Hanumangarh and south of Dabawati. These were minor channels belonging to the lower or the middle Pleistocene period and did not supply any waters during the late Pleistocene or the Holocene. However, spill water during the same area seems to have been a regular occurrence even in the historical times.

xii. Two thousand desert lakes in Nara and Khipro talukas were formed by the combined waters of the Sarsuiti and the Drishadvati during the later part of the upper Pleistocene (35,000 to 10,000 years ago), or even in early Holocene. These lakes are oriented towards NNE to SSW, along the course of the former streams.

xiii. Hakra or Sarsuiti had no major change in its course south of Chotiari Lake i.e., from this point to the sea via Umarkot, Naokot, Rahimki Bazaar, Sindhuri and Koree Creek, at least since middle Pleistocene (500,000 to 35,000 years ago). There was an oscillation of about 5-10 miles from east to west over the entire period. The dunes in this belt are not as high as to the east and were formed during upper Pleistocene (35,000 to 10,000 years ago).

xiv. The Hakra or Sarsuiti entered Chotiari and Jamrao Head at two different times but definitely during the late Pleistocene (35,000 to 10,000 years ago).

xv. During this period the Drishadvati had joined the Hakra or Sarsuiti along Hissar, Nihar and Suratgarh alignment. Change to Anupgarh took place during the early Holocene (10,000 years ago to 6,500 years ago).

xvi. The Hakra has westered above Chotiari in about 5 stages and as soon as it reached the present course of Rainee, it started flowing almost north to south. The fifth stage was; via the Rainee, the second stage; between Sorah and Jamrao Head and fourth stage; along the old course, which is known as Wahind.

xvii. When the River Indus and the Sutlej were in spate, they spilled. The spill channels of the Sutlej and of the Indus started north-west of Ghauspur (50 miles from the boundary of Sindh and opposite to Mithan Kot) in Rahim Yar Khan district, and also between Ubauro and Pano Akil. Their waters flowed into the Sarsuiti or Hakra or Eastern Nara, usually each year, even up to thirteenth century AD and occasionally thereafter.

xviii. It is not certain from aerial photographs if the whole of the Sutlej during pre-Pleistocene period passed into the Sarsuiti or only a part of it. During mid and late-Pleistocene the Sutlej was independent river allowing only its spill water to the Sarsuiti.

xix. The Indus culture settlements exist along the old courses of the Sarsuiti from Fort Abbas to Darwar fort, as investigated by Mughal. Stein investigated the following sites along Ghaghar and Hakra bed in Bikanir and eastern Bahawalpur: Badrakali, Mundra, Fatehgarh, Kalibangan, Bhawar, Badopal, Rangmahal, Karnisar, Sardargarh, Sohankot, Suwaiki, Bijnagar, Ramsinghpur, Binjor, Walar, Sandhnala, Kudwala and Luriwala. All these sites are either Chalcolithic (Indus culture) or early historical, going back to period of Vedic Aryans, not later than about 750 BC. The earlier sites go back to 2,300 BC.

xx. Once the Hakra or Sarsuiti became non-perennial, its contribution to the local economy was limited to pastoralism in Rajasthan and Cholistan, but in Sindh below Jamrao Head it supported some agriculture in summer, although not very regularly, probably up to 1200 AD, and occasionally after-wards, but this date cannot be stated with accuracy. There are however indications of occasional supply of water up to

mid eighteenth century.

xxi. Even as a non-perennial river it could not have been utilised for navigation at the time of Greek conquest of Sindh, in 325 BC and after-wards. As a perennial river it did contribute to navigation and means of communication with the other Indus culture cities in Sindh, Kutch, Kathiawar and Gujarat.

xxii. Rann of Kutch was always connected with the sea. It is possible that when the Indus discharged into Gulf of Sindh, this Gulf may have been a fresh water lake, for a few months a year, but in the months of low discharge of the River Indus, it definitely was a sea water gulf.

xxiii. Pari Nagar, claimed to be a port, could not have been a river port, but a sea port on the Gulf of Sindh.

xxiv. Pari Nagar now is quite far off from the Rann of Kutch, as the area in front of it was probably silted by Luni during past 1,000-1,500 years.

xxv. Even in its hay days, before 2,000 BC, the Hakra could not have irrigated any land in the Thar desert, except probably some Sailabi cultivation along its bed in winter, but below Jamrao Head it would have irrigated lands in the Indus plains on its right bank only.

xxvi. Vast stretches of alluvium under sands in parts of Sukkur district, Nara and Khipro taluka could have only been deposited by Sarsuiti-Drishadvati group during many millennia.

xxvii. A study of ancient cultures gives an indication that archaeological sites of the early (3,500 to 2,350 BC) and the mature Indus culture (2,350 to 2,000 BC) existed along the ancient courses of the Sarsuiti, Ghaghar (the main channel of the Sarsuiti, on which flourished Kalibangan) and the Chautang. The Iron Age or grey-ware sites (around 1,000 BC) also existed along the upper reaches of Ghaghar, but not along the lower reaches of the Sarsuiti (or Hakra proper) and not even along Chautang. This shows gradual drying up of the Sarsuiti-Drishadvati system. The supply of water declined very fast around 2,000 BC, destroying urban life, but yet some water was flowing seasonally to support the pastoral Rig Vedic Aryans, connected with grey-ware, and thus some settlements dating to even Gupta period (third to fifth centuries) survived on its banks.

xxviii. During Holocene spill waters from the Sutlej near Bahawalpur too reached the Sarsuiti or Hakra, but during inundation season only and continued doing so during the historical period.

xxix. Along major courses of the Sarsuiti and the Drishadvati there is fresh ground water, specially along Dharmi Khu, Ghantiali, Ghotarou and down to Shahgarh, where it is available at 30 to 40 metres depth. It appears that this ground water in the area moves under the old courses from Himalayas in a slow movement which takes centuries.

xxx. The Sarsuiti or Hakra was a river much smaller than the Sutlej - an immature and young river - still in the stage of cutting its own channel.

xxxi. The Sarsuiti or Hakra was an independent river, on which existed the Indus Civilization cities like Kalibangan and others.

xxxii. The Indus never discharged into the Hakra, but an eastern and less important branch of it – Puran, entered Hakra below Naokot.

xxxiii. Hakra never passed through Alore gorge. An eastern branch of the Indus was flowing through Alore gorge up to end of tenth century AD. Waters of Indus did not pass through the Alore gorge to reach the Hakra.

xxxiv. The Sarsuiti or the Hakra was a perennial river, water supply of which started reducing around 2,000 BC and the Indus Civilization cities on its banks started declining. The death of the river was slow. From perennial it turned non-perennial. Below Bahawalpur the river still had some quantity of water in summer months. So dwindling settlements survived on its banks for a long time, even during the Vedic and historical times.

xxxv. The ancient settlements along the banks of Hakra or Sarsuiti go back to the Indus culture times; 2,000 BC in its whole reach and; 2,350 to 1,650 BC below Naokot. Some of these have been located very close to its mouth in the Rann of Kutch i.e., near Rahimki Bazaar and Sindhuri.

xxxvi. After 1650 BC, when the Hakra entered Sindh, it had sufficient supply of water to help in raising some short term crops in the lower Sindh and Kutch in summer, for some years, for many centuries. At least after 500 BC, it became very irregular in summers and also its water reduced in terms of discharge and the number of days it flowed.

xxxvii. The Mehran is another name for the Indus. The Mehran never flowed through bed of the Hakra, nor did a branch of it.

xxxviii. The Hakra had never flowed through the present desert area of Thar Parkar district, as

many folklorists have thought and written, nor was Pari Nagar a port on it.

xxxix. The Hakra had always discharged into the Gulf of Sindh, then a sea creek, and then to the sea, via Koree Creek. Later on it discharged into the Rann of Kutch.

xl. The level of Rann of Kutch, a shallow sea gulf, gradually rose due to silt brought by the Indus, the Hakra, the Kutch streams and the Luni. Tectonic movements may also have added to the process, but the contribution of the last factor could not have been substantial as compared to silting. Earthquakes cannot produce a uniformly flat land as that of the Rann of Kutch.

xli. An eastern branch of the Indus discharged in Hakra, but below the line passing east to west from Tando Bagho i.e., below the present town of Naokot in Thar Parkar district. It continued doing so even up to 1758 AD, when a major hydrological change in course of the Indus at Hala cut off this source of supply. This eastern branch of the Indus was called Puran or Sanghro and its different channels of different periods are known as the Eastern Puran and the Western Puran.

xlii. This eastern branch of the Indus was never the main stream of the River Indus.

xliii. Archaeological sites in Jaisalmir district, to the east of the Rainee and the Wahind, can provide a clue to early settlements and civilizations in the region.

xliv. Important sites on Chitang or Chautang, after it westered near Hissar to meet Sarsuiti at Anupgarh, are; Bahadra, Nohar and Rowatsar. Important archaeological sites along the main Sarsuiti channel are; Hanumangarh, Pilibangan, Rangmahal, Sardargarh and Anupgarh in India, and Dhuldra, Mirgarh, Marot, Mangarh and Dingarh in Pakistan.

The Indian sites were examined by Stein (18 above) and Bahawalpur sites by Dr. Mughal (30 above). In Sindh Vinjrot and Dribh Buthi are two sites on Rainee and Nohoto and Garho Bhiro on the Eastern Nara or the Puran. All these sites belong to the Indus Civilization.

xlv. Sites along old courses leading to Khipro and Nara talukas have not been examined for their antiquity either in India or Pakistan.

36. FOLKLORISTS

The collection of some two score volumes of Sindhi folklore by Dr. N. A. Baloch, since mid-fifties for Sindhi Adabi Board, opened the way for a new pursuit into mediaeval poetry, thoughts, customs, beliefs and modes of life in the ancient Sindh. Full of legendary stories, many people have accepted folklore for a sober history. They, in vain, have been searching fictitious monuments, settlements and tracks of legendary romantic figures and trying to fit these into history, by distorting the latter. Below are a few versions of the folklorists:

I) The great folklorist Dr. Baloch many times has been tempted to prove the impossible. Basing on Tarikh-i-Tahri's legendary tyrant king of Alore, Dalu Rai's story that this maniac in 962 AD wanted the merchant Saiful-Maluk to have latter's beautiful mistress Badi-uj-Jamal, to spend a night into his chambers. Saiful-Maluk asked for a grace period of seventy-two hours. During the dark of the night, having engaged a fleet of paid labourers, he successfully diverted the River Indus, from the Alore gorge to a new bed and sailed away, depriving the city of Alore of water forever and causing it to fall in ruins. Dr. Baloch, probably having been influenced by Raverty (10 above) and like him believes that the River Indus was previously passing through the Alore gap, to the Eastern Nara bed and Saiful-Maluk successfully diverted it during the dark of one night. The Kotri Barrage was built on dry land and the River Indus was diverted through it. No less than 30 bulldozers of 150 horse power worked for nearly two years to perform the job. One horse power is equivalent to the power of 8 men working for 8 hours. One horse power working throughout a day and a night means work done by 24 men in one shift. In terms of man-day 30 bulldozers of 150 horse power working for 16 hours a day and 500 days in 2 years are equivalent to 12 lac (1.2 million) men working for 8 hours of one night, provided that those labourers can be obtained, their work coordinated, passing for movements provided and tools for excavation and haulage made available. Like Raverty, believing Saiful-Maluk to be genuine, Dr. Baloch has concluded that the Indus has in the past flowed into two groups of channels; the eastern system or Hakra through the edge of the desert and the western system through the central Sindh. He has even produced such a map, which is based on Henry Cousens, (13 above) with a few modifications. There are

other versions of Saiful-Maluk and Badi-uj-Jamal in Kashmir, and the Punjab and one such version is also in Persian, but none of these versions mention Dalu Rai of Sindh or changing course of the River Indus. Many ruins in Sindh are attributed to Dalu Rai. One mound of same name in the Punjab has been explored by the Archaeological Department of Pakistan. Dalu Rai and Saiful-Maluk both are legendary and so is this story. There is however, a bund not across the Hakra or the Nara, but across a spill channel of the Indus leading to Nara at Bihra, five miles east of Alore, built by Ghulam Shah Kalhora in sixties of seventeenth century for spreading the water of the River Indus into adjoining lands. Folklorist some how believe that this is the bund of Alore, built by Saiful-Maluk and Raverty too believed so.

II) The other folklore writer Ursani believed that a part of western Thar bordering the old bed of the Dhoro Puran was called Mehranno because it was adjoining Mehran or the Indus or the Hakra or Wahind, and this river irrigated the Mehranno of Thar (Mehran never passed along this route). He also believes that at one time the Hakra, a branch of the Indus starting in the Punjab, passed east of Umarkot through Thar to the Rann of Kutch near the Nagar Parkar taluka and Pari Nagar was a port on the mouth of the Hakra, in the first century AD.

Raichand Harijan in Tarikh-i-Registan has maintained the same versions verbatim, as of Ursani's. The former was encouraged to write on Registan by the latter and the draft copy of the book was also shown to Mr. Ursani, Raichand's book came out earlier than Ursani's by about a year. It is not certain who influenced whom on these folk-lore versions, which are totally incorrect. The Vol. II of Harijan's Registan has also repeated same versions.

III) In 1975, the late Dr. Abdul Majid Memon Sindhi combined some of the Western writings with folk-lore, to come to the conclusions, which are only partly correct. Those mentioned below are considered incorrect as concluded by the present writer in para 35 above. Further comments are given in the brackets.

a) During Ramayana period, elephants were supplied to Ajudhia from forests on the Hakra's banks.

(Ramayana was written around 400-200 BC, when the Hakra was too dry to support thick forests for elephants to live in).

b) Hakra tribe living in Sindh and Balochistan were boatmen, who sailed their boats on the Hakra River .

(The Hakra tribe could not be boatmen on a dry stream. The name Hakra for the dry bed of this river is less than 1,000 years old. Its original name known to Aryans was Sarsuiti, as mentioned in Vedas, Puranas and Mahabharata, all written between 1,000 to 200 BC. Its name, when Indus culture cities flourished on it, is not known. Thus there is no link between this tribe and the name of the river).

c) The Kot Dijji culture, which is different from the Indus Culture of Mohenjo Daro, established itself at Kot Dijji on the Hakra River .

(Kot Dijji was situated on the coarse of Indus passing through Alore Gorge and not on Hakra. Kot Dijji culture is categorised as the early Indus culture. All sites on the Sarsuiti usually are the mature Indus culture or Jhukar, Jhangar and cemetery-H culture. Only a few sites belong to early Indus culture, but all these cultures are the same.

d) The town of Sirsa was important rice market, situated on the Ghaghar, a tributary of Hakra.

(There is yet no evidence of rice cultivations on the Indus or its tributaries including the Sarsuiti or Hakra, during the Indus culture times, when the Sarsuiti was active).

e) When Aryans appeared in the South Asia, the Hakra along with its tributaries was mighty and perennial river . The Sarsuiti was another river between the Jammuna and the Sutlej, and had confluence with the Hakra.

(When Aryans appeared in the South Asia, around 1000 BC, the Hakra had already dwindled. The Sarsuiti was the Aryan's name for the streams now called the Hakra).

f) The Drishadvati, also called Chautang, which got its waters from the Jammuna, had confluence with the Ghaghar near Shor.

(The Drishadvati was an independent stream and was not fed by Jammuna, but had its independent source from Siwaliks).

g) The Sutlej was a tributary of the Hakra and confluence was a Valhar near the Bahawalpur border.

(The Sutlej was never a tributary of the Sarsuiti at least during Holocene or past 10,000 years).

h) Marot was a fort on the Hakra. It belonged to Umar Soomro, who kidnapped and interned

Marvi in the fort.

(Capital of Umar Soomro-I was Tharri and that of Umar Soomro-II, Muhammad Tur and Umarkot nor Marot. Marvi is legendary figure rather than historical. In Umar Soomro's times Hakra was dry. During Umar Soomro's rule Umarkot was called Amar Kot.

i) A canal from the Hakra took off near Dribh Dethari, a river port and on its way towards Jaisalmir, it bifurcated into two branches and one of them was called Ludano. Mumal's Kak (magic place) was located on Ludano, which dried up during the Soomra times, turning Kak into ruins.

(Contours of area show that land towards Jaisalmir is at the higher level and a canal can only flow from Jaisalmir towards Dribh Dethari. Ludano is only an ancient course of Sarsuiti belonging to pre-Holocene or the early Holocene period. Mumal and her Kak are legendary).

j) The Hakra passed through Alore gap and due to drying up of the Hakra Alore got deserted and turned into ruins. During the Soomra period there was a short supply of water in the Hakra and the ruler of Alore raised an embankment across it for diverting water to his lands and orchards.

(It was a branch of the Indus and not the Hakra that flowed through the Alore gap. Diverting of water of the Hakra on up-stream side, by a powerful landowner, was firmly believed by people until the British conquest of Sindh, when British engineers on checking found no truth in this story).

k) Below Alore, Hakra had many branches which finally discharged into the Indus. Kot Dijji, Halakandi or Hala, Brahmanabad-Mansura and Patala or Nerunkot or Hyderabad were situated on those branches of the Hakra.

(Level of the Hakra was too low for its waters to discharge into the Indus. All above towns existed on the Indus or on its branches. Patala may have been near or at the site of Brahmanabad i.e., Mansura - not near Hyderabad).

l) The Dhoro branch or Eastern Nara took off from the Indus near Alore and was flowing through bed of the Hakra during the Soomra dynasty's rule.

(It was spill waters of the Indus, rather than a branch of Indus, which fed the Hakra, but only during the inundation season. No branch of the Indus passed through the Alore gap to feed the Hakra).

m) There are a number of ruins on Hakra namely: Daseranjo Daro, Bhorijo Daro, Hamirojo Bhiro, Hasan Baghjo Bhiro, Patanjo Bhiro, Tubhianjo Daro, Ranejo Bhiro, Mumaljo Bhiro, Sonapariji Bhiri, Amrano, Rahundianji Bhiri, Garho Bhiro, Lehoorjo Bhiro, Lailanji Mari, Kinjhiji Mari or Bhiro, Kaunruji Mari, Noor Ali. Shahji Bhiri, Samijo Dher, Pahcatjo Bhiro, Nohoto Bhiro and Khanpurja Dara; all in Thar and belonging to the Soomra period, as the names show.

(These ruins belong to the Indus culture period i.e., 2,500 to 1,650 BC or earlier, but not to the Soomra period. The folklore names of Hamir, Rano, Mumal, Sonapari, Amrano, Lailan, Kinjhi and Kaunru cannot put them to twelfth to thirteenth centuries, nor can folklore stories prove that Hakra was flowing in twelfth to thirteenth centuries. We should, however, be grateful to the author for listing twenty-one sites on Hakra, which can be explored by archaeologists).

IV) Another folklorist, the late Mamoor Yousifani had been very active in interpreting of folk poetry and co-relating it with history and historical-geography. According to him:

a) The Wahind or Wahunday-jo-Darya, an eastern branch of the Hakra, passed through the Punjab, Bahawalpur and Jaisalmir and entered Sindh in Thar Parkar district. Pari Nagar was a sea port at its mouth on the Koree Creek at the place where it entered the sea.

(Pari Nagar is 120 miles east of Koree Creek. The port on the Koree Creek's mouth is Lakhpat).

b) The Wahind had two tributaries; the Sarsuiti and the Drishadvati, which dried up 3,000 years ago, but Wahind kept flowing, and when it dried up, is not known.

(If its sources dried up, where from did its water come?).

c) Mehran used to flow through Thar. Its route was from Vinjrot, Nara taluka and eastern part of Khipro taluka to Chhore, where it entered the Hakra.

(Contours of the area show that Vinjrot is at a lower level than the desert area of Khipro and Nara talukas, and therefore, no river can take this direction).

d) A branch of Hakra south of Umarkot made an easterly turn toward Chachro and from there to Pari Nagar.

(Contours cannot allow this to happen as Umarkot and Hakra are at a lower level than Chachro or its eastern parts).

e) A branch of Mehran on bifurcation near Naokot, passed near Diplo and etc.
(Contours cannot permit this to happen).

f) Another branch of Mehran called Meenni Nadi passed through Mithi, and on it flourished towns of Kerti and Karli Nagar.
(This flow would also be against contours).

g) Rainee was the third river of Thar Desert, which was flowing west of Hakra and after traversing desert parts of Khairpur and Sanghar districts entered the Thar desert near Shadipali. From thence it entered Samaro taluka and joined Hakra near Naokot. Important archaeological sites on this course are Daseran-jo-Bhiro, Bhori-jo-Shahar, Garho Bhiro, Lailan-ji-Mari and Patan or Lehoor.
(Yousifani's interpretation of river courses knows no limitations of hydrology or contours. Rivers flow from valleys to hills and jump from one hill to another without touching the valleys in between. Rivers and siphons fly across each other without difficulty and rivers fly across a hundred miles of the Rann of Kutch to the sea. Geography has no meaning in his interpretations).

The others categorised as historians but holding similar views on genuinely of Saiful-Maluk are: Maulai Shedai, Bhirumal, Shamsuddin and Arshad. Essentially they have taken folklore as sober history.

Folklorists have adhered to the poems of Mamui Fakirs and also to predictions of Girhori on the Hakra, as was done by Burton and Haig. Dr. Daudpotta, an authority on Girhori, considered these poems as forgery of early twentieth century and had even traced out the forger.

The above are only a few examples out of hundreds of versions of folklorists, repeated in various forms. There is no historical or scientific truth in them as is concluded in paragraph 35 (I to xiv) above.

The map Drying up of Sarsuti-Hakra shows various courses and their probable ages based on remote sensing technology.

TYPES OF CONSTRUCTION DURING SOOMRA PERIOD

887

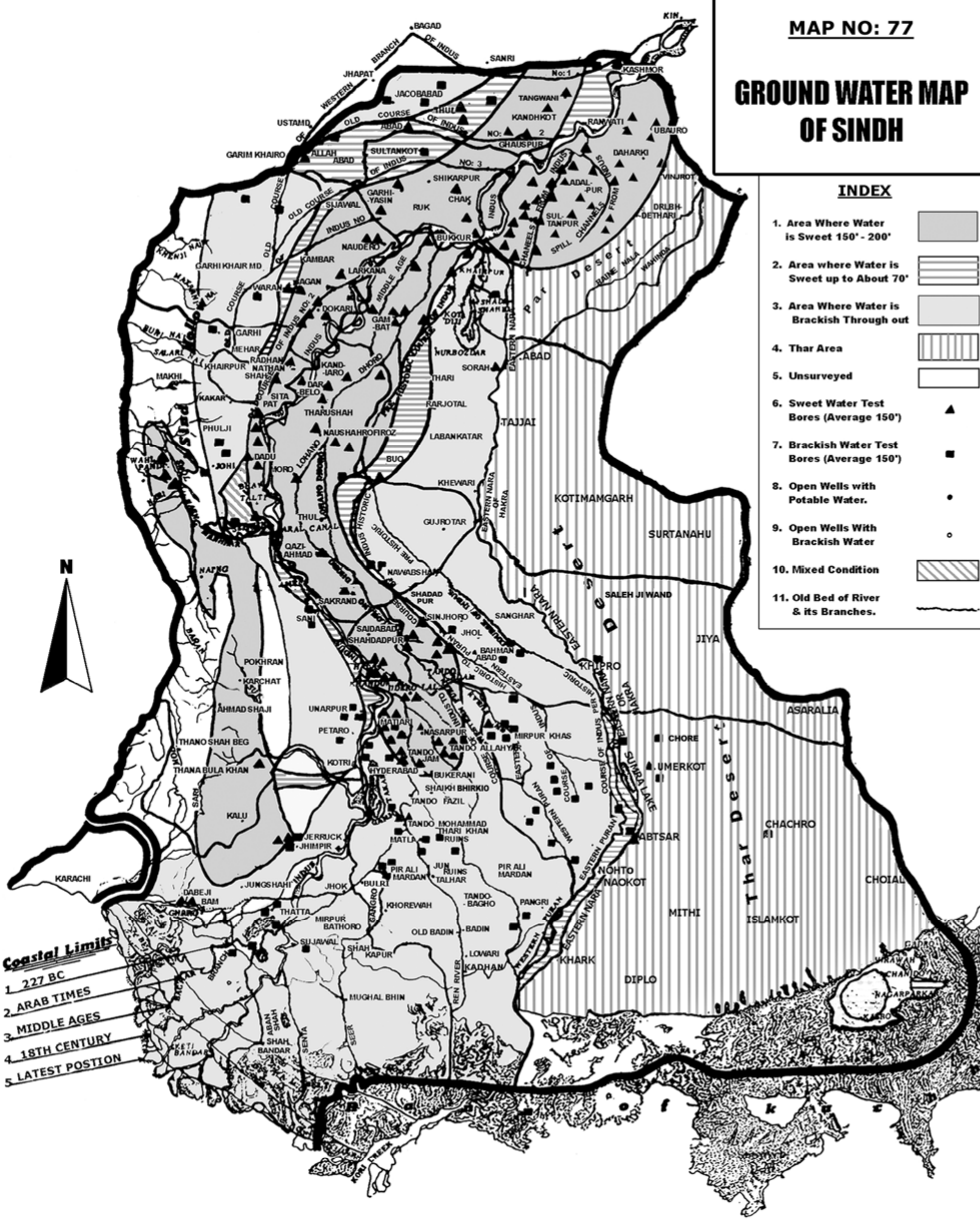

888


889


887. Wood reinforced house at Thatta. Reinforcement exposed. (MHP).
888. Wooden door of Zindah Pir tomb. (Cousens).
889. Multi story wood reinforced house at Thatta, with wind catcher at the top. (US).

MAP NO: 77

GROUND WATER MAP OF SINDH



Note:

Since river flowed through Lohano Dhoro or Khairpur course up to Sakrand, Shahdadpur and Samaro course, therefore sweet water zone existed much east to the present fresh water zone and it now is brackish from Nawabshah. On the west fresh water may have existed up to its present boundaries.

APPENDIX IV

GROUND WATER IN SINDH AND ITS POSITION IN NEAR FUTURE

The present writer published the book “Ground Water in Sindh” in 1964 and two years later Huntings Technical Services in Lower Indus Report opined that the ground water maps in this work were remarkably accurate. The work has not yet been superseded and is still valid. Since there were no tube-wells in Sindh then, a number of ground water indicators were used and for the benefit of general reader these are enumerated below:

a. The sea level rose; around 14,000 years ago it was near Multan and; around 6,000 years ago it reached to south of Hyderabad. Sea water seeped in the ground and consequently there are saline water concentrations up to a depth of 1,000 feet in the alluvial plains of Sindh. It was at varying depths of 20-40 feet from the surface. The River Indus had increased water discharge since about 10,000 years ago. It passed through the plains and changed its course frequently. Its waters seeped under ground and floated above the saline water of sea origin.

b. For interaction between fresh river water and saline ground water much depended on level of the latter below the soil level. The fresh water column on seeping exerted pressure on sea water displacing it and once displaced fresh water column become deeper and exerted more pressure and displaced more and more saline water. Thus in some areas in Sindh water is fresh even up to 600 feet and in others much less. It simply depended on how long the river flowed at particular place.

c. The other indicators were: changing courses of the River Indus, plants as indicators of ground water and its salinity, ancient settlements which could survive only if fresh ground water was available and ancient trade and traffic routes.

d. Study of changing courses of the River Indus shows that there is no place in Sindh even four miles long and four miles wide, which has not been visited by the river in the past 5,000-6,000 years.

e. When the river abandoned its course, water started changing quality due to evaporation from surface, evapo-transpiration by plants, flattening out of mound of water, river left within its percolation zone, and finally it’s mixing up with saline sea water from down below.

f. If the Indus had visited a site for a couple of centuries in the past 600 years, ground water was expected to be fresh, but if the river had flowed in that particular area from more than 600 years ago or had flowed there for less than 200 years, ground water was already saline.

g. In area where saline water was within 10-20 feet of surface, like the whole area south of the line running east to west from Shaikh Bhirkio, water remained brackish.

h. The same was true of Jacobabad and Shahdadkot, Kambar and Nasirabad talukas.

i. Eocene hills near Kashmore, Sukkur-Rohri, Sehwan-Daulatpur and Hyderabad contain salts, which have turned ground water brackish even in the river bed at all these points and about 5-10 miles north and south of these places, though the River Indus has been flowing near Sukkur since at least around 950 AD and near Hyderabad-Kotri since 1758 AD.

j. Water below Sehwan to Kotri is brackish as western hills, specially Manchar series, are impregnated with salts, and seepage of rain water from them to the River Indus makes water brackish even in the bed of the River Indus.

k. Below Kotri Barrage up to the sea water is saline in the whole area including the river bed due to simple reason that saline water table has remained within 10-15 feet of ground. Only shallow dug wells and hand pumps have supplied slightly brackish water. People use it for drinking purposes and for cattle, though by all standards it is not potable.

l. Ground water in the central alluvial plains is

fresh within 10-15 miles of the bed of the river, where the river has wandered during the past 600-700 years.

m. This fresh ground water 80-600 feet deep is underlain by saline water for the sea water origin and causes serious problems. When a tube-well, installed in fresh water aquifer, is pumped an inverted cone is formed above the point of maximum draw-down, i.e., along the tube-well pipe and a vacuum is created by suction pressure of the pump. This vacuum is to be counter-balanced in some way. Since saline water below fresh water is heavier, it rises in fresh water zone forming vertical cone to balance cone of depression cost by pumping tube-well. This continues every time tube-well is pumped and gradually fresh water tube-wells turns saline. If fresh water strata above saline water is 350 feet, tube-well is 200 feet deep, discharge is two cusecs and draw-down 15 feet, it may take 30,000 hours of pumping to turn it brackish. Many private tube-wells have turned brackish by this process in the past forty years, but individual complaints are never recorded and data is not available.

n. Solution to the problem is scavenger tube-wells, in which saline water forming a cone down below is pumped out simultaneously with fresh water being pumped out from the upper strata. It has worked satisfactorily and to retain ground water in fresh state, scavenger tube-wells have to be installed with every fresh water tube-well in Sindh, if tube-wells are to sustain.

o. Tube-wells are not run even for 8 hours a day. Of the 17,000 tube-wells in Sindh 13,000 are private having usual capacity of half to one cusec and 4,000 government owned and operated having average capacity of two cusecs. In the year 2,000 electric power was available for almost the whole day and night, and water shortage was so acute that tube-wells were running 24 hours from December 1999 to July 2000. Water table in such area dropped by 15 feet or more and centrifugal pumps had to be lowered to bring them close to water table.

p. The source of recharging water removed by tube-wells is irrigation water applied to the field. Unfortunately water allowance in Sindh is so small that the farmer has to spread water thinly in summer, when actually no seepage takes place, but seepage does take place in winter months. In summer salts build up in the soil and are drained down by excess irrigation water in winter to water table. The average salinity of drained water over years may be 2000 ppm. Over some years this is going to make the total ground water in Sindh unfit for cultivation. To maintain the same amount of intensity of cropping in Sindh, extra fresh water equivalent to presently pumped water is needed from the river sources.

q. Due to recent drought, to save crops, people have put tube-wells in brackish ground water areas. Such waters, though having C-class water of 900-1,200 ppm in shallow depths of first 30-50 feet, turn saline after pumping for a month or two or say 500-1,000 hours and ruin the land permanently. This has to be discouraged by law.

890. A view of Sukkur Barrage.

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ABOUT THE AUTHOR

M.H. Panhwar, born on Christmas day of 1925 at Ibrahim Kachi (Dadu), obtained bachelors degree in mechanical and electrical engineering from NED Engineering College, 1949 and M. Sc agricultural engineering, from University of Wisconsin at Madison (USA), 1953.

He served the Government of Sindh and the West Pakistan from 1953 to 1969; first four years as Agricultural Engineer in Sindh and other twelve years as Superintending Engineer Agricultural Machinery, to provide land leveling and ground water development facilities to farmers in Sindh and Baluchistan. During this period he increased fleet of bulldozers from thirteen to six hundred and employees from one hundred to six thousands. For their repairs he established thirteen repair shops, still in operation. He installed three thousand tube-wells in Sindh and one thousand in Baluchistan and wrote ten books on ground water, its occurrence, development and conservation. Of these, "Ground Water in Sindh", 1964, enlarged 1969, became classic reference book for farmers, government planners and tube-well drillers and has not been superseded yet.

From 1970 till breathing last had been running an engineering consulting company, specializing in irrigation, drainage, ground water, agriculture and scientific equipment for education, research and industry and worked only on government projects.

He continued ancestral occupation of farming and had established a horticultural research farm near Hyderabad (Sindh), in which he introduced twenty-five new fruit crops of which twelve were commercially grown. He developed a number of new and different fruit cultivars, which extend harvest season of each fruit by many months. He had also eliminated pesticides and herbicides from his farm, to make it fully organic during past decade of his life. For his researches on farm, he wrote manuals, one on each fruit crop, running into four thousand pages and another ten manuals on post-harvest of fruits and vegetables. He published more than eighty articles and books on engineering and agriculture and more fifty reports on scientific subjects.

His hobby had been studies in every aspect of Sindh since school days. As local libraries cannot afford to buy every book on Sindh or horticulture or engineering, he used to buy books for his personal collection and reference and had some fourteen thousand books on Sindh, equal number of books and bulletins on fruits crops, some twelve thousand books on engineering and environment and ten thousand books on other sciences; a total of fifty thousand books. His wife's collection was also some ten thousand books and publications available to them.

Of his writings on Sindh, "Source Material on Sindh", 1977 (600 pages), and "Chronological Dictionary of Sindh", 1983 (700 pages), are still referred as standard classics. His "An Illustrated Historical Atlas of Soomra Kingdom of Sindh" (2003), is considered as first comprehensive study on Soomra period history of Sindh. This has been translated in Sindhi and published under title "Tasweer-e-Sindh" (2006). A number of his books namely: "Historical Atlas of Sindh" (300 maps), "History of Sindh in Pictures", "Climatic changes and their Impact on History of Sindh" and three volume "Social History of Sindh" are ready for press.

He had published more than one hundred articles (nine hundred pages) on Sindh, which he had planned to publish as "Ancient Sindh". Lastly he wrote two books on Sindh: "Water Requirement of Riverain Area of Sindh", already published and "Kohistan Area of Sindh". For his 'Historical Atlas of Sindh' he had collected more than eighty historical atlases of different areas, many showing Sindh and besides three thousand maps showing Sindh. His wife Farzana supported him in all his researches, travels and office work. One of his four sons passed away during life and the remaining three stay in USA.

He received many awards for his work on Sindh, agriculture, science and technology, which included "Sitara-e-Imtiaz" (Star of Excellence) award by the President of Pakistan for work in engineering and agriculture in 1992 and another two awards followed in 1999 and 2002. He was well traveled and used to visit Europe and Northern America regularly for last four decades of his life in search of new knowledge in all fields of his interest.

His autobiography of the first ten years of his life (Sindhi version) has been published.

He passed way on 21.04.2007.